

**FROM DISCRETE TO SYSTEMATIC: MAINSTREAMING  
NATURE-BASED SOLUTIONS TO DISASTERS INTO  
ENVIRONMENTAL LAW IN CHINA**

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## INTRODUCTION

Natural disasters are “unnatural.”<sup>2</sup> The risk of disasters is often a combination of social, economic, and environmental factors, such as land planning,<sup>3</sup> poverty,<sup>4</sup> and deteriorating ecosystems.<sup>5</sup> At present, human activities could trigger or exacerbate the consequences of natural disasters on a global scale, putting the lives of millions of people at risk and undoing social and economic gains.<sup>6</sup> In particular, as climate change evolves, the number of natural disasters associated with it has significantly increased. For example, the number of annual flood disasters worldwide rose from 1,389 to 3,254 between 2000 and 2019, accounting for 40% of the total number of

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2. See Daniel A. Farber & Michael G. Faure, *Disaster Law*, 3 ELGAR RSCH. COLLECTIONS, at xiv (2010) (explaining that natural disasters are unnatural).

3. U.N. HUM. SETTLEMENTS PROGRAMME, LAND AND NATURAL DISASTERS: GUIDANCE FOR PRACTITIONERS 40 (2010), <https://unhabitat.org/land-and-natural-disasters-guidance-for-practitioners>.

4. Claude de Ville de Goyet & André Griekspoor, *Natural Disasters, the Best Friend of Poverty*, 14 GEO. J. ON POVERTY L. & POL’Y 61, 62 (2007) (discussing the strong positive relationship between natural disasters and poverty).

5. See ROBERT R.M. VERCHICK, FACING CATASTROPHE: ENVIRONMENTAL ACTION FOR A POST-KATRINA WORLD 1 (2010) (explaining that maintaining ecosystems is crucial for disaster mitigation).

6. U.N. OFF. FOR DISASTER RISK REDUCTION, GLOBAL ASSESSMENT REPORT ON DISASTER RISK REDUCTION: OUR WORLD AT RISK: TRANSFORMING GOVERNANCE FOR A RESILIENT FUTURE, at 2 (2022).

disasters and affecting 1.65 million people.<sup>7</sup> The number of annual storm disasters rose from 1,457 to 2,034 in that time, accounting for 28% of the total number of disasters.<sup>8</sup> In addition, the number of droughts, wildfires, extreme temperatures, and other natural disasters, such as earthquakes and tsunamis, have increased significantly.<sup>9</sup>

China experiences some of the most frequent and serious natural disasters in the world.<sup>10</sup> These natural disasters are diverse, widespread, frequent, and damaging<sup>11</sup> and have hindered China's sustainable development and "ecological civilization" construction.<sup>12</sup> In some ecologically fragile and economically impoverished areas, a negative feedback cycle occurs in which economic and social considerations influence development.<sup>13</sup> This in turn influences the level of ecological impact from frequent natural disasters.<sup>14</sup> Furthermore, ecologically fragile, vegetated areas in ecological transition overlap with areas in the composite interlaced zones of agriculture, forestry, and animal husbandry, which suffer from ecological problems as a result of short-sighted management.<sup>15</sup> According to the 2008 National Plan for the Protection of Ecologically Fragile Areas, economic losses in these areas due to various natural disasters, such as floods, sandstorms, mudslides, and landslides, cost about 200 billion yuan<sup>16</sup> per year,

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7. CTR. FOR RSCH. ON THE EPIDEMIOLOGY OF DISASTER & U.N. OFF. FOR DISASTER RISK REDUCTION, HUMAN COST OF DISASTERS: AN OVERVIEW OF THE LAST 20 YEARS (2000-2019), at 7–16 (2021).

8. *Id.* at 7–10.

9. *Id.* at 7.

10. See *The 14th Five-Year Plan for the National Emergency Response System*, STATE COUNCIL PRC, [https://www.gov.cn/zhengce/zhengceku/2022-02/14/content\\_5673424.htm](https://www.gov.cn/zhengce/zhengceku/2022-02/14/content_5673424.htm) (last visited Feb. 14, 2022) (explaining China's focus on creating a national disaster risk prevention plan).

11. GLOB. FACILITY FOR DISASTER REDUCTION & RECOVERY & WORLD BANK GRP., LEARNING FROM EXPERIENCE: INSIGHTS FROM CHINA'S PROGRESS IN DISASTER RISK MANAGEMENT 10-13 (2020).

12. The modern concept of "ecological civilization" currently being discussed in a Chinese policy context is largely based on the October 2007 Report of the 17th National Congress of the Communist Party of China (CPC)—the first instance of the term appearing in policy documents. This marked a paradigm shift in the development of an ecological civilization. Currently, the semantics of the term "ecological civilization" in China can be understood as a new paradigm of governance and development based on a political perspective—with environmental management, ecological restoration, and green development as the primary principles—distinct from industrial and agriculturally oriented civilizations. The political reports of the 17th, 18th, 19th, and 20th CPC have focused on ecological civilization and have continued to raise its status as a guiding principle in social development strategies and governance. See Bing Xue et al., *Understanding Ecological Civilization in China: From Political Context to Science*, 52 *ECOLOGICAL CIVILIZATION* 1895 (2023), <https://doi.org/10.1007/s13280-023-01897-2> (discussing the ecological civilization concept in the policy context); Lu Jiang et al., *Implement the Idea of Ecological Civilization and Enhance the Ability to Resist Natural Disasters*, 10 *SOC. GOVERNANCE REV.* 35 (2021).

13. See Guomin Wang, *Research on the Problems of Agricultural Natural Disasters and Rural Poverty*, *ECONOMIST* (2005) (describing this negative feedback loop).

14. *Id.*

15. *Outline of the National Plan for the Protection of Ecologically Fragile Areas*, MINISTRY OF ENV'T PROT. (Sept. 7, 2008), [https://www.gov.cn/gongbao/content/2009/content\\_1250928.htm](https://www.gov.cn/gongbao/content/2009/content_1250928.htm).

16. The current exchange rate between the Chinese yuan (RMB) and the USD is 7.23:1, so RMB 200 billion equals about \$28 billion.

and the natural disaster loss rate increases by an average of 9% per year, which is higher than the average GDP growth rate of ecologically fragile areas.<sup>17</sup> Additionally, between 1989 and 2019, the average annual disaster area of China's crops reached 40.2 million hectares, the average annual death toll was 870 (excluding 2008),<sup>18</sup> and more than 80% of disaster-related casualties and economic losses occurred in rural areas.<sup>19</sup> Extreme climate events frequently result in meteorological disasters because more than 70% of the 830 poverty-stricken counties in the country are in areas vulnerable to flooding and related disasters.<sup>20</sup>

In recent decades, ecosystem degradation induced many of the mega-natural disasters<sup>21</sup> that occurred in China.<sup>22</sup> In addition to natural conditions, human actions that cause deterioration of the ecological environment are important factors in mega-natural disasters.<sup>23</sup> These actions include significant farmland reclamation around lakes, which greatly shrinks the area of lakes and wetlands, causes severe damage to forest cover within the

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17. *Id.*

18. The Wenchuan earthquake happened in 2008, resulting in 69,227 deaths, 17,923 missing persons, 374,643 injured persons, and 19.9 million lost homes; 46.26 million people were affected in total.

19. Feng Kong, *China's Disaster Prevention and Mitigation System and Capacity Building in Rural Areas: Significance, Current Situation, Challenges and Countermeasures*, 21 DISASTER REDUCTION CHINA 10 (2020).

20. *Id.*

21. See Emergency Response Law of the People's Republic of China, art. 3 (dividing disasters and public health incidents into four levels of severity, the most severe being "mega-disasters"). According to such factors as the degree of social damage and extent of effects, natural disasters, accidental disasters, and public health incidents shall be divided into four levels: especially serious, serious, large, and ordinary, except as otherwise provided for by law. According to the Classification Criteria for Particularly Significant and Significant Public Emergencies (for Trial Implementation), the classification of mega-disasters will differ depending on the disaster. For example, "Mega-Water and Drought Disasters" include: (1) a mega-flood occurring in one basin or large floods occurring in several basins at the same time; (2) a levees breaking in an important section of the main channel of a major river or stream; (3) a dam holding a major reservoir collapsing; (4) flooding disrupting busy rail lines or interrupting the national highway network or major waterways for 48 hours; (5) an extremely large drought occurring in several provinces at once; and (6) extreme drought occurring in several large cities. Meanwhile, "Mega-Meteorological Disasters" include: (1) extremely heavy rain, heavy snow, tornadoes, dust storms, typhoons, and other extreme weather and climate events affecting important cities or areas of more than 50 square kilometers or resulting in more than 30 deaths or 50 million yuan of economic loss; (2) one or more provinces within the scope of the extreme weather and climate events or very strong catastrophic weather processes will occur, causing significant casualties and huge economic losses; and (3) extreme weather and climate events occurring in other countries or regions that may significantly impact China's economy or society.

22. For example, in 1998, Yangtze River suffered a basin-wide flood, which affected 30 provinces in the country; affected about 220 million people; caused more than 3,000 deaths; made 15 million people homeless; and resulted in direct economic losses of more than USD \$20 billion. See UN DISASTER ASSESSMENT & COORDINATION TEAM, FINAL REPORT ON 1998 FLOODS IN THE PEOPLE'S REPUBLIC OF CHINA (1998), <https://reliefweb.int/report/china/final-report-1998-floods-peoples-republic-china>. And in 2010, a devastating landslide occurred in Zhouqu County of the Gannan Tibetan Autonomous Prefecture within the Gansu Province, killing 1,557 people, leaving 208 missing, flooding two-thirds of Zhouqu County, and affecting 50,000 people. See L.Y. Jin et al., *The Characteristics and Forming Reasons of "8.8" Debris Flow at Luojiayu Gulley, Zhouqu*, 44 NW. GEOLOGY 10 (2011).

23. Hongbo Gu & Jian Gu, *On Characteristics, Distribution and Formation Mechanism of the Flood Disaster in China*, 11 J. SHANXI AGRIC. UNIV. (SOC. SCI. ED.) 1164 (2012).

watershed, and thereby contributes to increased soil erosion.<sup>24</sup> In 2010, for example, a devastating landslide occurred in Zhouqu County of the Gannan Tibetan Autonomous Prefecture within the Gansu Province, killing 1,557 people, leaving 208 missing, flooding two-thirds of Zhouqu County, and affecting 50,000 people in total.<sup>25</sup> Besides the natural causes of the disaster—geology, landscape, extreme rainstorms, and drought—human activities in Zhouqu, like poor urban planning, serious deforestation and land reclamation, and excessive development and construction of water conservancy resources, have aggravated disasters and their consequences.<sup>26</sup> Human action has also contributed to the frequent urban floods in recent years.<sup>27</sup> One of the leading causes is the rapid expansion of cities, which has diminished the ecological regulatory function of natural features, weakening urban stormwater management.<sup>28</sup>

It is essential to strengthen the sustainable use of natural resources and integrated ecosystem management for disaster risk reduction. In response to this need, the ecosystem-based approach to disaster risk reduction (EbA-DRR) has emerged.<sup>29</sup> This approach is based on management principles, strategies, and tools that maximize the use of ecosystem services to reduce disaster risk and achieve sustainable and resilient development goals.<sup>30</sup> In 2008, the World Bank proposed the exploration of nature-based solutions (NbS) as a strategy for mitigating and adapting to climate change.<sup>31</sup> Since then, the concept of NbS has become an umbrella for ecosystem-related approaches, which are defined as “actions to protect, sustainably manage and restore natural or modified ecosystems, which address societal challenges . . . effectively and adaptively, while simultaneously providing human well-being and biodiversity benefits.”<sup>32</sup>

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24. *Id.*

25. See Jin et al., *supra* note 22.

26. Haiyan Fang et al., *Causes and Countermeasures of Giant Flash Flood and Debris Flow Disaster in Zhouqu County in Gansu Province on August 7, 2010*, 8 *SCI. SOIL & WATER CONSERVATION* 14 (2010).

27. See generally Ruijie Jiang et al., *Substantial Increase in Future Fluvial Flood Risk Projected in China's Major Urban Agglomerations*, 4 *COMMUN. EARTH & ENV'T* 389 (2023) (explaining how the urbanization of land contributes to urban flooding), <https://www.nature.com/articles/s43247-023-01049-0.pdf>.

28. *Id.* at 7.

29. G.A. Res. 69/283, Sendai Framework for Disaster Risk Reduction (2015-2030) (Mar. 18, 2015) [hereinafter Sendai Framework].

30. *Id.* at 13.

31. WORLD BANK, BIODIVERSITY, CLIMATE CHANGE, AND ADAPTATION: NATURE-BASED SOLUTIONS FROM THE WORLD BANK PORTFOLIO (2008), [documents1.worldbank.org/curated/en/149141468320661795/pdf/467260WP0REPLA1sity1Sept020081final.pdf](https://documents1.worldbank.org/curated/en/149141468320661795/pdf/467260WP0REPLA1sity1Sept020081final.pdf).

32. IUCN, NATURE-BASED SOLUTIONS TO ADDRESS GLOBAL SOCIETAL CHALLENGES, at xii (E. Cohen-Shacham et al. eds., 2016), <https://portals.iucn.org/library/sites/library/files/documents/2016-036.pdf>.

Environmental law can be a powerful tool to ensure the implementation of NbS strategies in the context of disasters by focusing on ecosystem protection.<sup>33</sup> Coincident with the drafting of an ecological code in China, this paper aims to seize this opportunity to transform the legal application of NbS to disasters from discrete to systematic. This Article is structured in four parts. Part I provides an overview of the global natural disaster landscape, with a specific focus on China, including notable incidents like the 1998 Yangtze River floods, the 2010 Gansu Zhouqu mudslide disaster, and the growing issue of urban flooding. This Part also examines the intricate interplay between ecosystems and natural disasters.

Part II contends that environmental law can be the vehicle for utilizing NbS to mitigate natural disasters. This Part redefines natural disasters, acknowledging them as products of social, economic, and ecological factors. Consequently, comprehensive disaster risk management assumes paramount importance. Within this framework, NbS emerges as a novel model for disaster risk reduction, offering cost-effective, multifunctional, resilient, and stakeholder-inclusive strategies.<sup>34</sup> By analyzing some of China's long-standing ecological engineering projects—the 1978 Three North Shelterbelt project,<sup>35</sup> the 1988 Coastal Shelterbelt Program,<sup>36</sup> the 1989 Shelterbelt Program for Upper and Middle Reaches of Yangtze River,<sup>37</sup> and the 1999 Grain for Green project<sup>38</sup>—this Article underlines their notable achievements while also raising questions about their scientific and legal underpinnings.

Part III focuses on how the application of NbS to disasters is already part of Chinese environmental law. Through an examination of 42 pieces of environmental and related legislation, this Part presents an overview of the profiles and specific contexts of this function. Of these laws, 27 are dedicated in varying extents to disaster risk reduction, with ecological protection legislation being the most comprehensive. The analysis reveals that the

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33. U.N. OFF. FOR DISASTER RISK REDUCTION, NATURE-BASED SOLUTIONS FOR DISASTER RISK REDUCTION: WORDS INTO ACTION (2021), <https://wedocs.unep.org/handle/20.500.11822/40490;jsessionid=04C0C4D1390F0C880F42B64D22CFAA6F>.

34. GLOB. FACILITY FOR DISASTER REDUCTION & RECOVERY ET AL., NATURE-BASED SOLUTIONS FOR DISASTER RISK MANAGEMENT (2018), <https://documents1.worldbank.org/curated/en/253401551126252092/pdf/Booklet.pdf>.

35. See, e.g., *China's Three-North Shelterbelt Forest Program Brings Forest Coverage to 13.57 Pct*, XINHUA (Nov. 30, 2018), [http://www.xinhuanet.com/english/2018-11/30/c\\_137642405.htm](http://www.xinhuanet.com/english/2018-11/30/c_137642405.htm) (describing the 40-year progress of the initiative).

36. In 1988, the former State Planning Commission of PRC approved the “Overall Plan for the Construction of the National Coastal Shelterbelt System.”

37. Qingfeng Qin et al., *Review and Prospect of Protection Forest System Construction in the Yangtze River Basin in the Past 30 Years*, 16 SCI. SOIL & WATER CONSERVATION 145 (2018).

38. See, e.g., Suzanna Dayne, ‘Grain for Green’: How China Is Swapping Farmland for Forest, FORESTS NEWS (Nov. 28, 2017), <https://forestsnews.cifor.org/52964/grain-for-green-how-china-is-swapping-farmland-for-forest?fnl=en> (summarizing project progress since 1999).

existing disaster-risk-reduction function within environmental law encompasses both singular environmental measures and ecosystem approaches. The former primarily targets private entities, while the latter is chiefly steered by governmental entities without corresponding accountability requirements. Furthermore, the existing legal framework tends to prioritize isolated and discrete disaster risk prevention, sidelining the need for comprehensive and holistic risk management.

Part IV further elaborates on the characteristics of discrete nature-based solutions to disasters via the environmental legal system. This includes the scattered legislative model under the dominance of reductionism, the incomplete interaction between science and the legal system, and noticeable imbalances in rights, duties, and responsibilities. Lastly, this part also proposes how NbS should be systematically integrated into the draft of the Ecological Environment Code.

## I. NATURE-BASED SOLUTIONS TO DISASTERS IN CHINA

### A. Redefining Natural Disasters

The historical understanding of natural disasters has roughly gone through three stages: “Manifest Destiny,” “Scientific View,” and “Ecological View.”<sup>39</sup> Under the concept of Manifest Destiny, natural disasters are a supernatural and mysterious force.<sup>40</sup> Whether it was the “punishment of God” in European medieval culture<sup>41</sup> or the theory of ancient manifest destiny,<sup>42</sup> natural disasters were regarded as heaven’s punishment for human beings or as a warning to rulers.<sup>43</sup> Therefore, in the face of disaster, humanity’s response was mainly to reflect on its own actions and pray for forgiveness and solace.<sup>44</sup> With the spread of modern scientific ideas and the development of industrial technology, the world began to view nature as a passive machine with regular and predictable operation.<sup>45</sup> Consequently, natural disasters were seen as discrete, sudden events that deviated from normal regularity.<sup>46</sup> Later, under a more holistic approach, natural disasters

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39. Mingfang Xia, *Big Data and Ecological History: The Compilation and Database Construction of Historical Sources of Chinese Disaster History in an Information Age*, QING HIST. J., May 2015, at 67.

40. *Id.*

41. Elaine Fulton, *Acts of God: The Confessionalization of Disaster in Reformation Europe*, in HISTORICAL DISASTERS IN CONTEXT: SCIENCE, RELIGION, AND POLITICS 54 (2012).

42. YUNTE DENG, THE HISTORY OF FAMINE RELIEF IN CHINA 146 (1998).

43. *Id.*

44. KRISTIAN CEDERVALL LAUTA, DISASTER LAW 16 (2015).

45. Xia, *supra* note 39, at 67.

46. *Id.*

began to be understood in the context of overall ecosystem changes.<sup>47</sup> Natural disasters are now considered the comprehensive product of natural and social factors, and there is consensus that social attributes transcend natural attributes.<sup>48</sup> In 2012, the Intergovernmental Panel on Climate Change defined disasters as “[s]evere alterations in the normal functioning of a community or a society due to hazardous physical events interacting with vulnerable social conditions, leading to widespread adverse human, material, economic, or environmental effects that require immediate emergency response to satisfy critical human needs and that may require external support for recovery.”<sup>49</sup> As a result, the Sendai Framework for Disaster Risk Reduction calls for a comprehensive understanding of disaster risk, including systemic risks across multiple dimensions of natural hazard characteristics, exposure, and vulnerability.<sup>50</sup>

A comprehensive understanding of disaster risk requires the law to be adjusted in a timely manner. Focusing on the whole process of disaster prevention—including emergency response, rescue, and reconstruction—natural disaster law intersects with environmental law, insurance law, emergency response law, social assistance law, tort liability law, land planning law, urban and rural construction law, and other areas of law.<sup>51</sup>

### *B. Nature-Based Solutions to Disasters*

Applying NbS to disasters is the main component of the intersection between natural disaster law and environmental law, the heart of which is an ecosystem-based approach to disaster risk reduction. EbA-DRR is based on a series of ecosystem-management principles, strategies, and tools to maximize the use of ecosystem services to reduce disaster risk and achieve sustainable and resilient development goals.<sup>52</sup> Its core elements include: (a) recognizing ecosystem services;<sup>53</sup> (b) integrating sustainable livelihoods and development;<sup>54</sup> (c) integrating ecosystem investments;<sup>55</sup> (d) addressing and

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47. Tong Xing & Zhang Haibo, *An Analytical Framework of Disaster Management in the Context of China*, 1 SOC. SCIS. CHINA 132 (2010).

48. *Id.*

49. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, MANAGING THE RISKS OF EXTREME EVENTS AND DISASTERS TO ADVANCE CLIMATE CHANGE ADAPTATION 558 (2012), <https://www.ipcc.ch/report/managing-the-risks-of-extreme-events-and-disasters-to-advance-climate-change-adaptation/>.

50. Sendai Framework, *supra* note 29, at 1.

51. *See* Farber & Faure, *supra* note 2.

52. U.N. UNIV., THE ROLE OF ECOSYSTEMS IN DISASTER RISK REDUCTION 30 (Fabrice G. Renaud et al. eds., 2013).

53. *Id.* at 31–36.

54. *Id.* at 36–37.

55. *Id.*



reducing climate-change risks;<sup>56</sup> (e) strengthening ecosystem-based disaster-risk management capacity through multisectoral and multidisciplinary platforms;<sup>57</sup> (f) involving local stakeholders;<sup>58</sup> and (g) using existing ecosystem-management tools.<sup>59</sup>

In addition to EbA-DRR, ecosystem-based adaptation and disaster risk reduction through green infrastructure are also categorized as nature-based solutions to disasters.<sup>60</sup> Advocates of NbS for disaster risk reduction criticize traditional “gray engineering” because it tends to neglect the complexity and systematic nature of natural disasters.<sup>61</sup> Gray infrastructures for disaster prevention and mitigation tend to mislead people into thinking that places protected by engineering measures are safe, resulting in a false sense of security.<sup>62</sup> Additionally, such projects commonly cause serious damage to the environment.<sup>63</sup> The failure of such infrastructure aggravates the impact of disasters.<sup>64</sup> Moreover, NbS has the advantages of low cost, high efficiency, and wide application that make it more conducive to stakeholder participation.<sup>65</sup> NbS is one of the few ways exposed communities can reduce their exposure and vulnerability to all elements of disaster risk and thereby increase their resilience.<sup>66</sup> Ecosystems reduce exposure and mitigate the effects of disasters by providing natural protective barriers or buffer spaces.<sup>67</sup> Ecosystems also could reduce socioeconomic vulnerability by providing a subsistence environment and vital natural resources, such as water, food, medicine, and wood.<sup>68</sup> After a disaster, ecosystems and their resources are even more important to the affected areas, so they play an important role in the disaster resilience of the region.<sup>69</sup>

At the level of scientific application, different ecosystems can prevent and control natural disasters.<sup>70</sup> For example, coastal ecosystems with

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56. *Id.* at 37–38.

57. *Id.* at 41.

58. *Id.*

59. *Id.* at 39, 46.

60. Borja G. Reguero et al., *Nature-Based Solutions for Natural Hazards and Climate Change*, FRONTIERS ENV'T SCI., Dec. 2022, at 1; Press Release, U.N. Env't Programme, Green Infrastructure: Nature's Best Defence Against Disasters (May 19, 2019).

61. LIMIN ZHOU, A NEW THEORY OF WESTERN DISASTER SOCIOLOGY 172–75 (2015).

62. *Id.*

63. *Id.*

64. *Id.*

65. Karen Sudmeier-Rieux et al., *Scientific Evidence for Ecosystem-Based Disaster Risk Reduction*, 4 NATURE SUSTAINABILITY 803 (2021).

66. *Id.*

67. *Id.*

68. *Id.*

69. NAT'L INST. OF DISASTER MGMT., ECOSYSTEM APPROACH TO DISASTER RISK REDUCTION 9–13 (Anil K. Gupta & Sreeja S. Nair eds., 2012).

70. ADVANCES IN NAT. & TECH. HAZARDS RSCH., ECOSYSTEM-BASED DISASTER RISK REDUCTION AND ADAPTATION IN PRACTICE 1–20 (Fabrice G. Renaud et al. eds., 2016).

mangroves, swamps, wetlands, seagrasses, and sand dunes buffer against tropical tornadoes, storm surges, tsunamis, floods, coastal erosion, and other disasters.<sup>71</sup> River ecosystems, such as wetlands, lakes, reservoirs, and floodplains, prevent and control floods and droughts.<sup>72</sup> Forest ecosystems prevent and control disasters such as soil erosion, debris flows, landslides, and floods.<sup>73</sup> Once an ecosystem is damaged, its ability to mitigate and prevent disasters is weakened, which makes the ecosystem more vulnerable to future disasters.<sup>74</sup> Human activities play a decisive role in the positive feedback relationship between ecosystem degradation and natural disasters. Such activities include excessive reclamation, logging, mining, and various types of pollution discharge.<sup>75</sup> Consequently, whether the objective is improving ecosystem services or preventing ecosystem degradation, environmental law is one tool for adjusting humanity's interaction with the ecological environment, which plays a key role in disaster prevention and mitigation.<sup>76</sup>

*C. Top-Down Policies and Practices of Nature-Based Solutions to Disasters*

China's EbA-DRR is mainly top-down, meaning that the central government devises a policy by which the government implements large-scale ecological engineering.<sup>77</sup> The relevant rules governing specific planning, budget investment, fund management, construction standards, and other rules are mostly normative documents.

At present, China has many large-scale forestry projects underway. In 1978, the State Council tasked the State Forestry Administration with the Construction of Large Shelter Forests in Key Areas of Aeolian Sand Hazards and Soil Erosion in the Three Norths, marking the official start of the Three North Shelter Forest System construction project.<sup>78</sup> The project includes 551 counties in 13 provinces in northern China, from Bin County in Heilongjiang Province in the east to the Uzbeli Pass in Xinjiang Uygur Autonomous

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71. *Id.*

72. *Id.*

73. *Id.*

74. *Id.*

75. Yanjun Zhang et al., *Relationship Among Human Activities, Ecology-Environment and Natural Disasters*, 1 CHINA ENV'T MGMT. 30 (2003).

76. Daniel Farber, *Navigating the Intersection of Environmental Law and Disaster Law*, 6 BYU L. REV. 1783 (2011).

77. Ming Luo et al., *Development and Practices of Nature-Based Solutions in China*, 5 NATURE-BASED SOLS. 100109 (2024).

78. Li Shidong & Feng Deqian, *Three North Project: The World's Largest Afforestation Project*, CHINA.COM (June 28, 2021), [http://grassland.china.com.cn/2021-06/28/content\\_41604437.html](http://grassland.china.com.cn/2021-06/28/content_41604437.html).

Region in the west.<sup>79</sup> The project stretches 4,480 kilometers (km) from east to west and 1,460 km from north to south, with a total area of 4.069 million square km (42.4% of the country's land area).<sup>80</sup> The project is planned to last from 1978 to 2050, is divided into three stages and eight phases, will afforest 35.083 million hectares, and will increase the forest coverage rate from 5.05% to 14.95%.<sup>81</sup> Over the past 40 years, the Sanbei portion of the project has completed afforestation and preservation of 30.14 million hectares, and the forest coverage rate of the project area has increased from 5.05% to 13.57%.<sup>82</sup> The annual value of forest ecosystem services reached 2.34 trillion yuan.<sup>83</sup> The total investment was 102.83 billion yuan, of which the central government invested 33.38 billion yuan.<sup>84</sup>

In 1988, in order to prevent and control disasters such as typhoons, tsunamis, storm surges, and soil erosion, the State Planning Commission approved the compilation of the Overall Plan for the Construction of the National Coastal Protection Forest System by the Ministry of Forestry.<sup>85</sup> This marked the official initiation of China's Coastal Protection Forest System Construction Project (Coastal Forest Project).<sup>86</sup> The first phase of the project spanned 18,000 km from the Yalu River mouth in Liaoning Province in the north to the Beilun River mouth in Guangxi Province in the south.<sup>87</sup> It covered 195 counties across 11 coastal provinces and planned to afforest 2.491 million hectares.<sup>88</sup> In 2001, the second phase of the project was launched, and it was later revised and expanded to cover 261 counties in 11 coastal provinces.<sup>89</sup> In 2016, the third phase of the project was initiated, with its scope extending to 344 counties across the same 11 coastal provinces.<sup>90</sup> The total afforestation target for the third phase amounted to 8.0839 million hectares.<sup>91</sup> By 2020, after more than 30 years of implementation, a total afforestation area of 8.3152 million hectares had been achieved, equating to a forest coverage rate of 36.9% and a tree coverage rate of 39%.<sup>92</sup> The convergence of the core forest belts had been realized, forming a framework

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79. *Id.*

80. *Id.*

81. *Id.*

82. *Id.*

83. *Id.*

84. *Id.*

85. *World-Famous Ecological Project - China's "Coastal Shelter Forest System Construction Project"*, ZHEJIANG FORESTRY BUREAU (Apr. 19, 2022), [http://lyj.zj.gov.cn/art/2022/4/19/art\\_1277845\\_59029758.html](http://lyj.zj.gov.cn/art/2022/4/19/art_1277845_59029758.html).

86. *Id.*

87. *Id.*

88. *Id.*

89. *Id.*

90. *Id.*

91. *Id.*

92. *Id.*

for the Coastal Protection Forest System that combines “points” through village and town greening, “lines” through coastal core forest belt construction, and “areas” through afforestation of barren hills and wastelands and the establishment of a network of agricultural land forests.<sup>93</sup> According to estimates, the Coastal Protection Forest Project will provide nearly 1.26 trillion yuan in comprehensive annual benefits.<sup>94</sup> This includes 818.5 billion yuan in ecological benefits, 449.2 billion yuan in economic benefits, and 20 billion yuan in social benefits.<sup>95</sup>

In 1989, China launched the first phase of the construction of a shelter forest system in the Yangtze River Basin, with a planned afforestation task of 6.484 million hectares.<sup>96</sup> The construction scope of the second phase of the project (2001–2010) was expanded to the Yangtze, Huaihe, and Qiantang River basins, involving 1,035 counties in 17 provinces, and planning 6.8772 million hectares of afforestation.<sup>97</sup> The afforestation goal for the third phase of the project (2011–2020) is 5.3021 million hectares.<sup>98</sup> Since the project’s implementation, 11.84 million hectares of afforestation have been completed.<sup>99</sup>

In 2000, the project of returning farmland to forest and grassland was initiated by the Chinese government.<sup>100</sup> The purpose of the project is to restore cultivated land with serious soil erosion, salinization, desertification, or low and unstable grain yield by planting forests and grasslands and restoring vegetation according to local conditions.<sup>101</sup> By 2020, the central government had invested a total of 535.3 billion yuan to return farmland to forest and grassland in 2,435 counties in 25 provinces (including 213 million mu of returned farmland to forest and grassland),<sup>102</sup> directly benefiting 41 million rural households and 158 million farmers.<sup>103</sup> These projects are committed to preventing and mitigating land desertification, soil erosion, typhoons, tsunamis, storm surges, floods, droughts, and other geological

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93. *Id.*

94. *Id.*

95. *Id.*

96. *World-Renowned Ecological Project – China’s “Coastal Shelterbelt System Construction Project”*, ZHEJIANG FORESTRY BUREAU (Apr. 19, 2022), [http://lyj.zj.gov.cn/art/2022/4/19/art\\_1277845\\_59029758.html](http://lyj.zj.gov.cn/art/2022/4/19/art_1277845_59029758.html).

97. *Id.*

98. *Id.*

99. *Id.*

100. See generally Li Shidong & Liu Moucheng, *The Development Process, Current Situation and Prospects of the Conversion of Farmland to Forests and Grasses Project in China*, 13 J. RES. & ECOLOGY 120 (2022), <https://www.jorae.cn/CN/10.5814/j.issn.1674-764x.2022.01.014> (summarizing the project).

101. *Id.* at 120.

102. A mu is a Chinese unit of measurement equivalent to approximately one-fifteenth of a hectare. See [http://www.onlineunitconversion.com/mu\\_to\\_hectare.html](http://www.onlineunitconversion.com/mu_to_hectare.html).

103. Shidong & Moucheng, *supra* note 100, at 120.

disasters.<sup>104</sup> According to the definition of “natural” in the International Union for the Conservation of Nature (IUCN) report on NbS,<sup>105</sup> these ecological projects work mainly by creating new ecosystems for disaster prevention and mitigation that are different from existing ones.

However, due to a long-term dependence on central policies without the benefit of a complete and effective legal system, these artificial ecological programs have also encountered many problems. The foremost problem is that the effectiveness of those programs has been questioned.<sup>106</sup> Due to the complexity of natural ecosystems,<sup>107</sup> the first doubt facing such large-scale ecological projects is whether they are scientifically sound.<sup>108</sup> The early stages of the projects’ implementation raised attention to their potentially harmful consequences. For example, the early afforestation method of the Three North project was mainly intended to create an artificial, unitary forest with a single species of tree—mainly poplars, which grow rapidly but have a lifespan of about 30 years—so there are many low-quality and degraded forests with many premature, aging, and dead trees.<sup>109</sup> Because of planners’ failure to fully consider the capacity of water resources, the high afforestation density, and a lack of necessary maintenance in the early stage, the final afforestation rate for the project was just 46.9%.<sup>110</sup> The same situation also appears in other projects. For example, according to the evaluation results of the Coastal Shelterbelt Program, the stock of arboreal forest in the coastal shelterbelt accounts for only 55.3% of the national arboreal forest stock.<sup>111</sup> Following this program, the local forest ecosystem has weaker regulating

104. NAT’L DEV. & REFORM COMM’N, NATIONAL MASTER PLAN FOR MAJOR PROJECTS TO PROTECT AND RESTORE IMPORTANT ECOSYSTEMS (2021-2035) (2020), <https://www.ndrc.gov.cn/xxgk/zcfb/tz/202006/P020200611354032680531.pdf>.

105. The IUCN report classifies “nature” in nature-based solutions into three categories: all-natural ecosystems, protected or restored ecosystems, and reconstructed ecosystems. IUCN, *supra* note 32.

106. See, e.g., Kaiji Xu et al., *How Are Nature-Based Solutions Contributing to the Improvement of Ecosystem Quality in China: A Systematic Review*, 155 *ECOLOGICAL INDICATORS* 110985 (2023) (concluding that natural factors contribute more to such programs’ effectiveness than human intervention).

107. Pietro Landi et al., *Complexity and Stability of Ecological Networks: A Review of the Theory*, 60 *POPULATION ECOLOGY* 319 (2018).

108. Shixiong Cao et al., *Excessive Reliance on Afforestation in China’s Arid and Semi-Arid Regions: Lessons in Ecological Restoration*, 104 *EARTH-SCI. REVS.* 240 (2011); Yang Xiao et al., *Ecological Risks Arising from the Impact of Large-Scale Afforestation on the Regional Water Supply Balance in Southwest China*, *SCI. REPS.*, Mar. 2020, at 1, <https://www.nature.com/articles/s41598-020-61108-w>; C. Li et al., *Drivers and Impacts of Changes in China’s Drylands*, 2 *NAT. REVS. EARTH & ENV’T* 858 (2021).

109. *The Information Office Held a Press Conference on the “Comprehensive Evaluation Report on the Construction of the Three-North Protective Forest System for 40 Years”*, STATE COUNCIL (Dec. 24, 2018), [https://www.gov.cn/xinwen/2018-12/24/content\\_5351500.htm](https://www.gov.cn/xinwen/2018-12/24/content_5351500.htm).

110. Zhu Jiaojun & Zheng Xiao, *The Prospects of Development of the Three North Afforestation Program (TNAP): On the Basis of the Results of 40-Year Construction General Assessment of the TNAP*, 38 *CHINESE J. ECOLOGY* 1600 (2019).

111. NAT’L FORESTRY ADMIN., NATIONAL COASTAL SHELTER SYSTEM CONSTRUCTION PLAN (2016-2025), <https://www.gov.cn/xinwen/2017-05/16/5194348/files/8cfb540b5ff744518f1f05abdd201bdd.pdf>.

services because of the artificially low number of plant species. Since the project area spans five climatic zones, there are, in theory, numerous native tree species. Despite this, some areas of the coastal shelterbelt have poor geological conditions, singular species, and a simple structure.<sup>112</sup> These effects contribute to poor stability in the forest's ecosystem and congenital deficiencies in protective function.<sup>113</sup>

The next problem faced by these large-scale ecological engineering projects is the dilemma of legitimacy.<sup>114</sup> The rights, obligations, and accountability frameworks of these projects are not explicit in the construction process due to the projects' top-down, policy-based approach. The construction process often contains non-transparent information and monitoring procedures.<sup>115</sup> A project's construction may pose many scientifically questionable or unreasonable aspects. These aspects could affect the ecological, social, or economic efficiency of the process—or even cause devastating damage to the original ecosystem.<sup>116</sup> However, neither the government planners nor the companies and individuals who implement the project are typically held accountable for the results of such an “act of God.”<sup>117</sup> In 2023, Guoyou Sun's video “Kneeling for Water” highlighted these legal issues for public discussion.<sup>118</sup> Civil society praised Guoyou as a hero for the prevention of desertification.<sup>119</sup> After this incident, some ethically minded netizens questioned whether Guoyou Sun was a hero or a businessman with ulterior motives.<sup>120</sup> Certain ecologists and social

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112. *Id.*

113. *Id.*

114. Jianfeng Jeffrey Qi & Peter Dauvergne, *China and the Global Politics of Nature-Based Solutions*, ENV'T SCI. & POL'Y, Nov. 2022, at 1.

115. Ruizi Yu & Quan Mu, *Implementation Progress of Nature-Based Solutions in China: A Global Comparative Review*, 4 NATURE-BASED SOL. 100075 (2023).

116. Julia Marinaccio, *Banning Logging, Conserving Legitimacy: Large-Scale Ecological Restoration Under Xi Jinping*, J. ENTWICKLUNGSPOLITIK, Mar. 2020, at 1, <https://www.researchgate.net/publication/337591162>.

117. Qun Du & Zhiyu Huang, *On the Tort Liability of the State for Inaction in the Management of Natural Disasters*, 15 J. CHINA UNIV. GEOSCI. (SOC. SCIS. EDITION) 37 (2015).

118. In March 2023, 64-year-old Guoyou Sun posted a video online in which he could be seen kneeling on the ground begging for water, sounding hoarse and appearing quite desperate. The video quickly made headlines in major media and attracted widespread attention. Prior to this, Sun Guoyou appeared as a hero in sand control, and his deeds of selling property into sand control were widely known. According to him, the reason for the video was that a coal mine in the sandy land destroyed the water source of the sandy forest, and although he won the case, the coal mine did not fulfill the water supply, resulting in the lack of water for what he called a “10,000 mu forest farm.” Later, the incident attracted the attention of local government departments and extensive discussion on the Internet. Some members of the media asked four questions about the incident: (1) Is there a forest farm of 10,000 acres? (2) Are the trees suitable for local cultivation? (3) Based on the water supply agreement, is the coal mine or forest farm in the wrong? (4) Is planting trees on a forest farm itself destroying the ecology? But so far, these inquiries have not received authoritative official answers. POLAR EYE NEWS (Apr. 2, 2023), <https://news.ifeng.com/c/8Of58xt62XB>.

119. *Id.*

120. *Id.*

organizations also believed that if 20-year-old, fast-growing poplars still needed watering, the solution was not to combat desertification but to instead install “pumps” in the desert.<sup>121</sup> Legal scholars and lawyers had considered the water-supply dispute between Guoyou and Shuangma Coal Mine,<sup>122</sup> but until now the relevant regulatory authorities’ information disclosure and review of the project has been inadequate. China is facing increasingly serious natural disasters and ecological degradation. These two issues interact with each other, increasing the demand for ecosystem regulation services alongside the upgraded model of disaster risk reduction.<sup>123</sup> On the other hand, there are scientific doubts and legitimacy dilemmas in the existing EbA-DRR framework.<sup>124</sup> Accordingly, addressing such issues should be a priority of environmental lawyers in the area of disaster risk reduction.<sup>125</sup>

## II. THE STATUS OF NATURE-BASED SOLUTIONS TO DISASTERS IN ENVIRONMENTAL LAW

### A. *The Development of Chinese Environmental Legislation*

After the Chinese delegation participated in the Stockholm Conference in 1972, China began to attach more importance to environmental protection.<sup>126</sup> In 1973, the country promulgated its first policy document on environmental protection: *Several Provisions on the Protection and Improvement of the Environment (Trial Draft)*.<sup>127</sup>

The 1978 Constitution declared that “the State protects the environment and natural resources and prevents and eliminates pollution and other hazards to the public.”<sup>128</sup> In 1979, the first Environmental Protection Law (For Trial

121. Sun Guoyou *Planted Trees to Destroy the Ecology: What He Planted Was a Desert Pump*, SOHU (Apr. 2, 2023), [https://www.sohu.com/a/661893875\\_120514500](https://www.sohu.com/a/661893875_120514500).

122. *Environmental Resources Experts Analyze the Core Legal Issues of the “Ningxia Forest Farm Owner Seeking Water” Incident*, SINA (Mar. 30, 2023), <https://finance.sina.com.cn/jjxw/2023-03-30/doc-imynsptw4584793.shtml>.

123. Ning Zhao, *Promote Synergies Between Ecological Protection and Disaster Prevention and Mitigation*, CHINA NAT. RES. NEWS (Feb. 9, 2022).

124. Xin Mao, “*Ecological Restoration*” *Is a Good Lesson that Should Not Be Misread* (Aug. 30, 2023), [http://www.banyuetan.org/jrt/detail/20230830/1000200033134991693210299533141545\\_1.html](http://www.banyuetan.org/jrt/detail/20230830/1000200033134991693210299533141545_1.html).

125. Zhiyu Huang, *The Failures and Countermeasures of the Legal System’s Implementation of Ecosystem-Based Disaster Management*, 32 ECOLOGICAL ECON. 214 (2016).

126. Zhou Shengxian, *The Development History and Effectiveness of Environmental Protection in My Country*, MINISTRY OF ENV’T PROT. (July 11, 2013), [https://www.mee.gov.cn/gkml/sthjbgw/qt/201310/t20131009\\_261311.htm](https://www.mee.gov.cn/gkml/sthjbgw/qt/201310/t20131009_261311.htm).

127. *Id.*

128. CONSTITUTION OF THE PEOPLE’S REPUBLIC OF CHINA (1978), art. 11, para. 3.

Implementation)<sup>129</sup> was enacted.<sup>130</sup> Since then, China has promulgated the Laws for the Prevention and Control of Water, Air, Solid Waste, Noise, Radioactive, and Soil Pollution.<sup>131</sup> Additionally, the state promulgated the Law on Natural Resources, which governs Water, Land Management, Grassland, Forest, and Mineral Resources.<sup>132</sup> These laws together constituted an environmental legal system.<sup>133</sup> With the promotion of the Preventive and Precautionary Principle,<sup>134</sup> the approach has gradually shifted to whole-process governance.<sup>135</sup>

Consequently, statutes like the Circular Economy Promotion Law, Cleaner Production Promotion Law, and Environmental Protection Tax Law have been promulgated successively, which have amended the initial command-and-control measures for environmental protection by incorporating an administrative and marketing mechanism.<sup>136</sup> However, due to the long-term dominance of reductionist theory, China's environmental legislation predominantly focuses on the qualitative or quantitative environmental elements of natural resources without holistic, systematic thinking.<sup>137</sup> As a result, in the process of implementing the aforementioned laws, difficulties often arise in determining which of several potentially responsible government agencies should take the lead on a particular project.<sup>138</sup> For example, new legislation on ecosystem integrity has been introduced, including the Yangtze River Protection Law,<sup>139</sup> the Yellow River

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129. The “For Trial Implementation” version of the law is intended to test the social effects of laws and regulations after they are enacted and is necessary to implement the enacted laws for a certain period of time, to determine problems with the laws, and to amend them before formal enactment.

130. Environmental Protection Law (for Trial Implementation) of the People's Republic of China (1979), <https://www.tandfonline.com/doi/abs/10.1080/00094609.2004.11036404>.

131. See discussion *infra* Section II(D).

132. *Id.*

133. Zhongmei Lu & Yiran Wu, *The 70 Years of Chinese Environmental Rule of Law: From the Past to the Future*, 5 CHINA L. REV. 102 (2019).

134. The preventive and precautionary principles are landmark principles of international environmental law. A distinction can be made between these two principles: prevention addresses tangible risks whilst precaution deals with scientific uncertainty. See Nicolas de Sadeleer, *The Principles of Prevention and Precaution in International Law: Two Heads of the Same Coin?*, in RESEARCH HANDBOOK ON INTERNATIONAL ENVIRONMENTAL LAW 152–88 (Malgosia Fitzmaurice et al. eds., 2010), <https://tradeenvironment.eu/wp-content/uploads/2021/10/Research-Handbook-of-IEL.pdf>.

135. *Id.*

136. *Id.*

137. Lu Zhang, *Chinese-Style Legal Synergy Concept that Promotes the Harmonious Coexistence Between Man and Nature*, 45 LEGAL RSCH. 19 (2023).

138. *Id.*

139. Zhongmei Lu, *Legal Thoughts on the Enactment of the Yangtze River Protection Law*, 2 ORIENTAL L. 79 (2020).



Protection Law,<sup>140</sup> and the Qinghai-Tibet Plateau Ecological Protection Law.<sup>141</sup>

### *B. Disputes over the Chinese Environmental Legal System*

From the early controversy over whether environmental law was an independent branch of law,<sup>142</sup> to the current dispute over the proper scope of the Ecological Code (Code),<sup>143</sup> China's environmental legal system has long been subject to a fundamental theoretical debate.

Professor Canfa Wang believes that the legal system for an ecological civilization construction should contain seven parts: (1) the Basic Law on Ecological Civilization Construction, (2) the Law on Pollution Prevention and Control, (3) the Law on Natural Resources Protection, (4) the Law on Ecological Protection, (5) the Energy Law, (6) the Law on Climate Change, and (7) the Law on Special Environmental Management Systems.<sup>144</sup>

Professors Xisheng Huang and Yucheng Shi believe that the Chinese environmental legal system is based on the Environmental Protection Law and governs seven sub-legal areas: (1) the Environmental Pollution Prevention and Control Law, (2) the Natural Resources Protection Law, (3) the Ecological Protection Law, (4) the Resource Recycling Law, (5) the Energy Conservation and Emission Reduction Law, (6) the Disaster Prevention and Mitigation Law, and (7) the Environmental Damage Liability Law.<sup>145</sup>

Professor Zhongmei Lu believes that the normative system of the Code includes pollution control, natural ecological protection, and green and low-carbon development legal norms. Additionally, Professor Zhongmei Lu believes that natural ecological protection includes legislation related to natural resources, regional, and watershed legislation.<sup>146</sup> Although scholars have different views, the various pollution prevention laws, the natural

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140. Xueyong Hou, *A Survey of the Ecological Protection Mechanism of the Yellow River Basin from the Perspective of Coherence Theory – Take the Relevant Provisions of the Yellow River Protection Law as the Analysis Object*, 3 LEGAL F. 105 (2023).

141. Gu Gong, *Qinghai-Tibet Plateau Ecological Protection Law and New Development of Environmental Legislation Model*, 51 ENV'T PROT. 23 (2023).

142. Bopin Wen, *Environmental Protection Law Is an Independent Branch of Law*, 2 L. SCI. MAG. 29 (1980); but see Jiwen Chang, *Environmental Law Is a Field of Law but Not an Independent Branch of Law*, SCI. NET (Sept. 10, 2010), <https://news.sciencenet.cn/sbhtmlnews/2010/9/236588.html>.

143. Cao Wei, *Theoretical Reflection and Program Construction on "Moderate Codification" of Environmental Law*, 29 LAW & SOC. DEV. 113 (2023).

144. Canfa Wang, *On Establishment for Legal Guarantee System of Ecological Civilization Construction*, 3 CHINA L. SCI. 34 (2014).

145. Xisheng Huang and Yucheng Shi, *The Structure and Improvement of China's Environmental Legal System*, 28 CONTEMP. L. REV. 120 (2014).

146. Zhongmei Lu, *Construction of the Normative System of Environmental Code under Typological Thinking*, 44 MOD. L. SCI. 89 (2022).

resources law, the ecological protection law, and the green and low-carbon development law are widely recognized as components of the environmental legal system, so this Article will emphasize them.

This Article will analyze 42 pieces of Chinese environmental and natural disaster legislation, including 3 comprehensive pieces of legislation: the Environmental Protection Law, the Marine Environmental Protection Law, and the Environmental Impact Assessment Law.<sup>147</sup> It will also analyze 7 pieces of pollution-prevention-and-control legislation: the Laws on Prevention and Control of Water Pollution, Atmospheric Pollution, Solid Waste, Radioactive Pollution, Environmental Noise, Soil Pollution, and Environmental Protection Tax Law.<sup>148</sup> Further, it will examine 13 pieces of natural-resource legislation: fisheries, water, forests, grasslands, land, mineral resources, sea areas, islands, deep-seabed-area resources, wildlife, coal, biosecurity, and black-soil-protection laws.<sup>149</sup> Additionally, this Article will examine 7 examples of ecological protection legislation, which govern water and soil conservation, desertification prevention and control, the Yangtze River, wetlands, the Yellow River, the Qinghai-Tibet Plateau, and the decree on nature reserves.<sup>150</sup> The analysis will also include 4 green and low-carbon development laws: the Renewable Energy Promotion Law, Energy Conservation Law, Circular Economy Promotion Law, and Cleaner Production Promotion Law.<sup>151</sup> Finally, the Article analyzes 8 natural disaster laws that contain cross-cutting environmental laws and regulations, which concern flood prevention, meteorological, protecting against and mitigating earthquake disasters, infectious disease prevention and decree of geological disaster prevention and control, drought resistance, forest fire prevention, grassland fire prevention.<sup>152</sup>

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147. *Review and Understanding of Ecological and Environmental Protection Legislation in the Past 40 Years of Reform and Opening Up*, NAT'L PEOPLE'S CONG. OF THE PRC, [http://www.npc.gov.cn/npc/c12434/wgggkf40nlfcjgs/202108/t20210824\\_313202.html](http://www.npc.gov.cn/npc/c12434/wgggkf40nlfcjgs/202108/t20210824_313202.html).

148. *Id.*

149. *Id.*

150. *There Are More Than 30 Laws on Ecological and Environmental Protection to Promote the Construction of a Beautiful China*, NAT'L PEOPLE'S CONG. OF THE PRC (Aug. 15, 2023), [http://www.npc.gov.cn/npc/c2/kgfb/202308/t20230815\\_430991.html](http://www.npc.gov.cn/npc/c2/kgfb/202308/t20230815_430991.html).

151. *Notice of the State Council on Issuing the Action Plan for Carbon Peaking Before 2030*, No. 23, STATE COUNCIL, P.R.C. (Oct. 26, 2021), [https://www.gov.cn/zhengce/content/2021-10/26/content\\_5644984.htm?eqid=a4b97eeb0002d62b00000003645bab58](https://www.gov.cn/zhengce/content/2021-10/26/content_5644984.htm?eqid=a4b97eeb0002d62b00000003645bab58).

152. *At Present, My Country Mainly Has 5 Laws and 9 Administrative Regulations in Terms of Disaster Prevention and Relief*, CENT. PEOPLE'S GOV'T OF THE PRC, [https://www.gov.cn/zxft/ft129/content\\_1022484.htm](https://www.gov.cn/zxft/ft129/content_1022484.htm).

### C. Types of Natural Disasters and Disaster Risk Reduction

According to the national standards for the classification of natural disasters, there are five categories of natural disasters.<sup>153</sup> The first category includes meteorological and hydrological disasters, such as drought, flood, typhoon, heavy rain, strong wind, hail, lightning, low temperature and high temperature, ice and snow, sandstorms, and fog.<sup>154</sup> The second category is geological disasters, including earthquakes, volcanoes, collapses, landslides, debris flows, ground subsidence, and ground fissures.<sup>155</sup> The third category is marine hazards, which include storm surges, waves, sea ice, tsunamis, and red tides.<sup>156</sup> The fourth category is biological disasters, which include plant diseases and pests, epidemics, rodent pests, grass pests, and grassland fires.<sup>157</sup> The final category contains ecological and environmental disasters, including soil erosion, wind-eroded desertification, salinization, and rocky desertification.<sup>158</sup>

Disaster risk reduction includes the processes of disaster prevention and early warning, emergency relief, and recovery and reconstruction.<sup>159</sup> The Article categorizes these methods as either “explicit” or “implicit.” The “explicit” category includes normative content that expressly relates to disaster risk management. “Implicit” norms, meanwhile, do not name disaster risk reduction expressly, but authoritative legislative interpretations and provisions have clarified their relevance to disaster risk management.<sup>160</sup> This Article will review in detail where and how the application of NbS to disasters is embodied in the legal system.

### D. The Profile and Expressions of Nature-Based Solutions to Disasters

#### 1. The Profile

As shown in Table 1, 27 of the 42 environmental laws are dedicated to disaster risk reduction. These include the Environmental Protection Law as

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153. GEN. ADMIN. OF QUALITY SUPERVISION, INSPECTION & QUARANTINE, NATIONAL STANDARDS OF PRC: NATURAL DISASTER CLASSIFICATION AND CODING, GB/T 28921-2012 (2013).

154. *Id.*

155. *Id.*

156. *Id.*

157. *Id.*

158. *Id.*

159. ASIAN DISASTER REDUCTION CTR., TOTAL DISASTER RISK MANAGEMENT – GOOD PRACTICES 14 (2005).

160. The distinction between explicit and implicit functions draws on the theory of legal function. Explicit function refers to the fact that the objective consequences of the law conform to the original intention of the legislator or are intentionally arranged by the legislator. The implicit function refers to the fact that the impact of the law on society is unseen or unintended; that is, the consequence exceeds the legislature’s original intent. ZITANG FU, LEGAL FUNCTIONALISM 51 (1999).

the comprehensive “Basic Law”;<sup>161</sup> 3 pollution-related laws governing soil pollution, water pollution, and solid waste; 11 pieces of natural resources legislation, governing issues arising with respect to land, mineral resources, water, fisheries, coal, forests, grassland, sea areas, islands, wildlife, and black soil; and 6 pieces of ecological protection legislation, including the Law on Water and Soil Conservation, the Law on Desertification Prevention and Control, the Law on the Protection of Wetland Areas, the Law on the Protection of the Yangtze River, the Law on the Protection of the Yellow River, and the Law on the Ecological Protection of the Qinghai-Tibet Plateau.<sup>162</sup> In addition, 6 cross-cutting natural disaster laws regulate environmental social relations to achieve the goals of disaster risk reduction: the Flood Prevention Law, the Meteorological Law, the Law on Protecting Against and Mitigating Earthquakes, the Law on the Prevention and Control of Infectious Diseases, the Decree on the Prevention and Control of Geological Disasters, and the Decree on Drought Control.<sup>163</sup>

According to Table 1, there are 163 environmental normative provisions at the specific regulatory level related to disaster risk reduction.<sup>164</sup> The ecological protection laws contain the greatest number of these normative provisions (96).<sup>165</sup> This is followed by natural resources (32), natural disasters (27), pollution prevention and control (7), and the comprehensive category (1).<sup>166</sup> Legislation related to green and low-carbon development does not contain any such normative provisions.<sup>167</sup> Among all normative provisions, 4 specific environmental statutes establish the purpose of disaster risk prevention and mitigation: the Water Law,<sup>168</sup> the Water and Soil

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161. Interview with Bie Tao, Chief Legal Advisor and Director of the Department of Regulations and Standards of the Ministry of Ecology and Environment: “Use the Strictest System and Strictest Rule of Law to Protect the Ecological Environment.”, S. WEEKEND (Oct. 20, 2022), [https://www.infzm.com/contents/236739?source=101&source\\_1=236736,20](https://www.infzm.com/contents/236739?source=101&source_1=236736,20).

162. Hongzhen Xia, *China’s Ecological and Environmental Protection Legal System Has Been Basically Formed* (Oct. 25, 2022), [www.npc.gov.cn/npc////c2/kgfb/202210/t20221025\\_319868.html](http://www.npc.gov.cn/npc////c2/kgfb/202210/t20221025_319868.html).

163. Li Zhengwei, *Ministry of Emergency Management: We Are Accelerating the Legislative Process of the Natural Disaster Prevention and Control Law*, GUANGMING.COM (Nov. 14, 2023), [https://politics.gmw.cn/2023-11/14/content\\_36965300.htm](https://politics.gmw.cn/2023-11/14/content_36965300.htm).

164. See Table 1, *supra* Section II(D).

165. Qun Du, *The Conceptual Composition of the Ecosystem-Based Disaster Mitigation Law: The Synergistic Jurisdiction of the Ecological Protection Law and the Natural Disaster Law*, 13 ENV’T RES. L. REV. 97 (2021).

166. See Table 1, *supra* Section II(D).

167. *Id.*

168. See *Zhonghua Renming Shuifa* (中华人民共和国水法) [Water Law of the People’s Republic of China] (promulgated by the Standing Comm. Nat’l People’s Cong., Jan. 21, 1988, rev’d July 2, 2016, effective July 2, 2016), art. 1, 2002, translated in 2016 P.R.C. LAWS (“This Law is formulated for the rational development, utilization, saving and protection of water resources, for the prevention and control of water disasters and for the realization of sustainable utilization of water resources in order to meet the needs in national economic and social development.”).

Conservation Law,<sup>169</sup> the Yellow River Protection Law,<sup>170</sup> and the Qinghai-Tibet Plateau Ecological Protection Law.<sup>171</sup> The terms also contain a drought control decree that includes regulations intended to prevent and mitigate drought disasters and their losses, ensure domestic water usage, and coordinate production and ecological water usage.<sup>172</sup> Additionally, 3 articles embody the principle of coordinated governance between ecosystem protection and disaster risk reduction: Article 4 of the Water Law,<sup>173</sup> Article 3 of the Law on Desertification Prevention and Control,<sup>174</sup> and Article 4 of the Flood Prevention Law.<sup>175</sup> Other than these overarching goals and basic principles, the other provisions assessed are all specific rules.

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169. See *Zhonghua Renming Shuitubaochi Fa* (中华人民共和国水土保持法) [Water and Soil Conservation Law of the People's Republic of China] (promulgated by the Standing Comm. Nat'l People's Cong., Dec. 25, 2010, effective Mar. 1, 2011), art. 1, 2011, *translated in* 2010 P.R.C. LAWS ("This Law is formulated to prevent and control water and soil loss, protect and reasonably utilize water and soil resources, reduce disasters of flood, drought and sandstorm, improve the ecological environment and guarantee sustainable economic and social development.").

170. See *Zhonghua Renming Huanghe Baohufa* (中华人民共和国黄河保护法) [Yellow River Protection Law of the People's Republic of China] (promulgated Oct. 30, 2022, effective Apr. 1, 2023), art. 1, 2023, *translated in* 2023 P.R.C. LAWS ("This Law is developed for the purposes of strengthening the protection of the ecology and environment of the Yellow River basin, guaranteeing the safety of the Yellow River, promoting the conservation and intensive utilization of water resources, driving high-quality development, protecting, inheriting, and promoting the Yellow River culture, and realizing the harmonious coexistence between man and nature and the sustainable development of the Chinese nation.").

171. See *Law of the People's Tibetan Plateau Ecological Protection*, art. 1, 2023 P.R.C. LAWS (China) (explaining that the law was "enacted for the purposes of strengthening the ecological protection of the Tibetan Plateau, preventing and controlling ecological risks, guaranteeing ecological security, building a hub of national ecological civilization, promoting sustainable economic and social development, and achieving the harmonious coexistence of man and nature").

172. See *Zhonghua Renmin Gongheguo Fang Han Tiaoli* (中华人民共和国防旱条例) [Drought Control Regulation of the People's Republic of China] (promulgated by the State Council, Feb. 26, 2009, effective Feb. 26, 2009), art. 1 (regarding China's law on preventing and relieving drought disasters and the losses caused by them).

173. See *Water Law of the People's Republic of China*, *supra* note 168 ("The development, utilization, preservation, and protection of water resources and the prevention and control of water disasters shall be carried out through comprehensive planning, with all factors taken into consideration. The planning shall seek both a temporary solution and a permanent cure, with emphasis on multipurpose use and achieving maximum benefits to take advantage of the multiple functions of water resources and harmonize water use in production and the environment.").

174. See *Zhonghua Renmin Gongheguo Fang Sha Zhi Sha Fa* (中华人民共和国防沙治沙法) [Law of the People's Republic of China on Desert Prevention and Transformation] (promulgated by the Standing Committee Nat'l People's Cong. on Aug. 31, 2001, effective Jan. 1, 2002), art. 3 ("Desert prevention and transformation shall follow the following principles: . . . (3) combining the protection and restoring of vegetation with the reasonable utilization of natural resources; (4) Following environmental rules and relying on technological advancement.").

175. See *Zhonghua Renmin Gongheguo Fanghong Fa* (中华人民共和国防洪法) [Flood Control Law of the People's Republic of China] (promulgated by the Standing Comm. Nat'l People's Cong., Aug. 19, 1997, rev'd July 2, 2016, effective July 2, 2016), art. 4 ("Water resources shall be developed, utilized and protected in conformity with the overall arrangement for flood control and in adherence to the principle of deriving benefits being combined with eliminating damage.").



**Table 1: An Overview of Disaster Prevention and Mitigation in Chinese Environmental Legislations<sup>176</sup>**

Categories of Legislation	Explicit Categories	No. of Terms	Type of Norm		
			Goal	Principle/ Philosophy	Specific Rule
Comprehensive (3)	1	1	0	0	1
Pollution Prevention & Control (7)	3	7	0	0	7
Natural Resources (13)	11	32	1	1	30
Ecological Protection (7)	6	96	3	1	92
Green & Low-Carbon (4)	0	0	0	0	0
Natural Disasters (8)	6	27	1	1	25
Total (38)	27	163	5	3	155

## 2. The Concrete Expressions

This Section will analyze the rules presented above in Table 1. Analyzing existing Chinese environmental legislation will demonstrate various patterns in the disaster risk reduction function in Chinese environmental law by identifying who is subject to them, what behaviors they regulate, which disaster types they address, their specific functions, and the nature of the norms they provide.<sup>177</sup>

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176. *See supra* Section II(D) (discussing methodology).

177. *See infra* Table 2.

**Table 2: The Concrete Expressions of Disaster Risk Reduction in Chinese Environmental Legislation**

Number of Rules/Types of Law		Compr. (1)	Poll. Ctrl. (7)	Natural Resource (30)	Ecol. Protection (92)	Natural Disaster (25)	Total (155)
Subjects Regulated <sup>178</sup>	Gov't <sup>179</sup>	1	4	20	65	19	112
	Enterprises & Business Unit	0	2	1	1	1	6
	Unspecified	0	2	9	23	8	41
	Other <sup>180</sup>	0	0	0	5	0	5
Behavior <sup>181</sup>	Ecology & Env't Protection	1	2	6	59	12	80
	Env't Pollution Prevention/Ctrl.	0	4	0	2	3	9
	Sustainable Use of Resources	0	0	12	22	14	48
	Engineering, Sci., & Tech.	0	1	8	9	0	18
	Financial Incentives	0	0	4	0	0	4
Disaster <sup>182</sup>	Natural Disaster	0	2	4	14	0	21
	Meteorological & Hydrological Disasters	0	5	18	22	17	64

178. See Zhonghua Renmin Gongheguo Turang Wuran Fangzhi Fa (中华人民共和国土壤污染防治法) [Law of the People's Republic of China on Prevention and Control of Soil Contamination] (promulgated by the Standing Comm. Nat'l People's Cong. Aug. 31, 2018, effective Jan. 1, 2019), art. 44 (exemplifying how an Article can have different types of legal relationship subjects, e.g., by involving local people's governments and their departments, enterprises, public institutions, producers, and operators).

179. The government here includes the state, the State Council, the people's government and its responsible departments, and responsible authorities in the legislative provisions.

180. "Other" includes enterprises involving agriculture; forestry; animal husbandry; and fishery, planting, and breeding households.

181. See, e.g., Yellow River Protection Law, *supra* note 170, art. 44 (discussing both mine-pollution prevention and ecological restoration).

182. See, e.g., Zhonghua Renmin Gongheguo Huanjing Baohu Fa (中华人民共和国环境保护法) [Environmental Protection Law of the People's Republic of China] (promulgated by the Standing Comm. Nat'l People's Cong., Dec. 26, 1989, rev'd April 24, 2014, effective April 24, 2014), art. 53, *translated in* 2014 P.R.C. Law 9 (exemplifying an article with many types of disasters, such as land desertification, rocky desertification, soil erosion, plant diseases and pests).



Number of Rules/Types of Law		Compr. (1)	Poll. Ctrl. (7)	Natural Resource (30)	Ecol. Protection (92)	Natural Disaster (25)	Total (155)
	Seismic/Geologic Hazards	0	0	1	5	9	15
	Marine Disasters	0	0	0	1	0	1
	Biological Disasters	1	0	3	3	1	8
	Ecological & Env't Disasters	1	0	7	63	0	72
Functions <sup>183</sup>	Synthesis	0	0	12	32	8	54
	Prevent/Warn	1	5	18	48	11	85
	Emergency/Rescue	0	2	3	3	7	15
	Recovery/Reconstruction	0	0	1	8	1	10
Nature of Norms <sup>184</sup>	Compound (Authority & Duty)	1	4	20	65	18	108
	Empowering	0	0	0	0	0	0
	Instructive	0	0	0	0	0	0
	Imperative	0	2	7	18	5	32
	Prohibitive	0	2	4	17	4	25
Method of Embodiment	Explicit	1	0	27	91	22	141
	Implicit	0	7	3	1	3	14

183. *See, e.g.*, Zhonghua Renmin Gongheguo Senlin Fa (中华人民共和国森林法) [Forest Law of the People's Republic of China] (promulgated by the Standing Comm. Nat'l People's Cong., Sept. 20, 1984, rev'd Dec. 28, 2019, effective July 1, 2020), art. 34, 2020 P.R.C. LAWS 39 (exemplifying how one Article can have multiple functions, in this case both "delimiting forest fire prevention areas, stipulating fire prevention periods, and establishing monitoring and early warning systems and emergency response plans").

184. The complex norms of authority and responsibility are rules that stipulate the functions and powers of state organs. A norm of rights is a rule that stipulates the rights of a natural person, legal person, or other organization. Guiding norms are those under which the actor has discretion to act according to the behavior specified by the rules; thus, the rules are suggestive and non-binding. An imperative norm, on the other hand, sets out positive obligations, and prohibitive norms are rules that set out negative obligations.

Number of Rules/Types of Law		Compr. (1)	Poll. Ctrl. (7)	Natural Resource (30)	Ecol. Protection (92)	Natural Disaster (25)	Total (155)
Liability	Admin. Penalty, Coercion, Detention, etc.	0	4	4	13	3	24
	Administrative Sanctions	0	0	1	3	0	4
	No Liability	1	3	23	76	22	127

Table 2 indicates that environmental legislation presents different manifestations of disaster management. First, disaster risk reduction is generally approached through both the environmental-management and ecosystem-based approaches. The environmental-management approach is different from EbA.<sup>185</sup> EbA focuses on the overall ecosystem structure and functioning to maintain the health of ecosystem services, which is a priority.<sup>186</sup> In contrast, the environmental-management approach does not necessarily focus on whole ecosystems, but it may instead simply address issues around natural resource use in the context of disaster management.<sup>187</sup> There are two main groups of entities implementing the two different approaches. Private entities are mainly obligated to reduce disaster risk through environmental management; that is, they are prohibited or restricted from discharging specific pollutants or from utilizing natural resources in the name of disaster prevention and mitigation. For example, the Water Pollution Prevention and Control Law, the Solid Waste Pollution Prevention and Control Law, the Water Law, the Fishery Law, and the Mineral Resources Law all prohibit various private actions. These activities include discharging pollutants, dumping solid waste, planting trees in floodways, developing aquaculture on water beaches, and discarding mineral resources in a manner that causes flooding.<sup>188</sup>

185. ECOSYSTEM APPROACH TO DISASTER RISK REDUCTION, *supra* note 69, at 29.

186. *Id.*

187. *Id.*

188. *See, e.g.*, Shui Wuran Fangzhi Fa (水污染防治法) [Water Pollution Prevention and Control Law] (promulgated by the Standing Comm. Nat'l People's Cong., May 11, 1984, rev'd June 27, 2017, effective Jan. 1, 2018), art. 38, 2018 P.R.C. LAWS 70 ("It is prohibited to stockpile or store solid wastes and other pollutants at bench land and bank slopes below the highest water level of rivers, lakes, canals, channels and reservoirs."); *see e.g.*, Gutu Feuwi Wuran Huanjing Fangzhi Faa (固体废物污染环境防治法) [Law on the Prevention and Control of Environment Pollution Caused by Solid Wastes] (promulgated by the Standing Comm. Nat'l People's Cong., Oct. 30, 1995, rev'd Apr. 29, 2020, effective Sept. 1, 2020),

On the other hand, the “Nation” or “Government” and its relevant agencies are the main entities implementing EbA-DRR and NbS measures. These entities implement disaster prevention and mitigation from the macro and abstract levels to ensure the success of ecological protection and restoration.<sup>189</sup> The Government has created initiatives to prevent and control natural disasters, such as the ecosystem-disaster, coordinated-monitoring, and early-warning mechanisms;<sup>190</sup> standard system;<sup>191</sup> planning coordination;<sup>192</sup> mega-ecological engineering construction;<sup>193</sup> comprehensive management;<sup>194</sup> and other measures or systems. All these measures are intended to support and protect ecosystem functions.

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art. 38, 2020 P.R.C. LAW 43 (China) (“Any entity or individual shall be prohibited from dumping, stacking, or storing solid wastes in a river, lake, canal, channel, or reservoir, or its beach and sloping bank below the high-water mark, or any other place specified by any law or regulation.”); *see, e.g.*, Water Law of the People’s Republic of China, *supra* note 168, art. 37 (“It is prohibited to abandon or pile in any river, lake, reservoir, or canal objects that block the passage of floodwater. Planting trees or growing crops of a long-stalk variety that may block the passage of floodwater is also prohibited.”).

189. *National Disaster Reduction Commission’s Notice on Issuing the “14th Five-Year Plan” Notice of the National Comprehensive Disaster Prevention and Reduction Plan*, NAT’L DISASTER RISK REDUCTION COMM. (June 19, 2022), [https://www.mem.gov.cn/gk/zfxxgkpt/fdzdgnr/202207/t20220721\\_418698.shtml](https://www.mem.gov.cn/gk/zfxxgkpt/fdzdgnr/202207/t20220721_418698.shtml).

190. *See, e.g.*, Changjiang Baohu Fa (长江保护法) [Yangtze River Protection Law] (promulgated by the Standing Comm. Nat’l People’s Cong., Dec. 26, 2020, effective Mar. 1, 2021), art. 7, 2021 P.R.C. LAWS 65 (China) (“The departments of ecology and environment, natural resources, water administration, agriculture and rural affairs, standardization, and other relevant departments of the State Council shall, in accordance with the division of responsibilities, establish and improve a standards system for the water environment quality and pollutant discharge, ecological and environmental restoration, conservation and intensive use of water resources, ecological flow, biodiversity protection, aquaculture, and disaster prevention and reduction, among others, in the Yangtze River Basin.”).

191. *See id.* art. 9 (“The National Yangtze River Basin Coordination Mechanism shall coordinate the improvement by the relevant departments of the State Council of the monitoring network system and monitoring information sharing mechanism for the ecology and environment, resources, hydrology, meteorology, shipping, and natural disasters, among others, in the Yangtze River Basin on the basis of established stations and monitoring projects.”).

192. *See, e.g.*, Yellow River Protection Law, *supra* note 170, art. 23 (“The department of water resources of the State Council shall, in conjunction with the relevant departments of the State Council and provincial people’s governments in the Yellow River basin, and under the principles of unified planning, management, and allocation, legally make comprehensive plans, water resource plans, and flood control plans, among others, for the Yellow River basin, and make arrangements on the conservation, protection, development, and utilization of water resources and the prevention and treatment of water disasters.”).

193. *See id.* art. 31 (“The local people’s governments at and above the county level in the Yellow River basin shall take measures such as building shelter forests, prohibiting grazing for restoration of grassland, fixing sand with engineering projects at the edge of sandy lands, closing off desertified land for protection, and rodent control to enhance the protection and restoration of natural forests, wetlands, and grasslands in the important ecologically functional areas of the Yellow River basin, carry out large-scale desertification prevention and control, scientifically control desertified land, and shall implement ecological restoration projects in key areas such as Hetao Plain Area, lake atrophy and degradation zones of the Inner Mongolia Plateau, desertified area of the Loess Plateau, and Fenwei Plain Area.”).

194. *See id.* art. 68 (“The state shall support the relevant local people’s governments in the Yellow River basin in planning as a whole the protection and restoration of river shorelines and the return of cultivated land to wetland, and constructing a green ecological corridor integrating the functions of flood control and ecological protection under the premise of stabilizing river regime, regulating flow paths, and ensuring flood passage capacity.”).

As for the types of natural disasters contemplated under the current legal framework, Table 2 demonstrates that current environmental law considers all kinds of natural disasters to some degree. The disasters that most frequently appear in the provisions examined are ecological environmental disasters (72), followed by meteorological and hydrological disasters (64)—particularly soil erosion, land desertification, flood, and drought.<sup>195</sup> These disasters occur more frequently because of their complex origins, relationship with the ecological environment, and close connection with human activities.<sup>196</sup> Therefore, these issues belong to the field of “synergistic resonance,” which lies somewhere between the fields of ecological protection and disaster risk reduction.<sup>197</sup> For example, a set of special legislation exists for marine protection, including the Marine Environmental Protection Law, the Island Protection Law, and the Marine Utilization and Management Law. Only Article 40 of the newly promulgated Wetland Conservation Law, however, provides for restoring mangrove wetland habitat to mitigate marine disaster risks.<sup>198</sup>

Next, Table 2 outlines regulated entities’ legal relationships to these risk-reduction provisions by summarizing the rights, duties, and liabilities associated with each law. The government promulgates absolute legal statutes, which constitute a top-down, command-and-control management model.<sup>199</sup> Of the laws related to disaster risk reduction, there are 108 articles with norms of a compound nature. These 108 articles outline the powers and obligations of the government and its relevant departments in the context of disaster risk reduction, but only one article specifies that the head or executor of the administrative authority is subject to “administrative sanctions.”<sup>200</sup> In addition, there are two prohibitive norms,<sup>201</sup> both of which permit local governments at or above the county level to reject projects. These projects include cultivating windbreak and sand-fixation forest networks, practicing forest harvesting, and reclaiming desert edge areas, woodlands, and

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195. The data was compiled by the author after a review of the above-mentioned law.

196. Yi Wang et al., *Evolution Characteristics of Global Meteorological and Hydrological Disasters from 1990 to 2019*, 44 *TRANSACTIONS ATMOSPHERIC SCI.* 496 (2021).

197. Huang, *supra* note 125.

198. Shidi Baohu Fa (湿地保护法) [Wetlands Conservation Law] (promulgated by the Standing Comm. Nat’l People’s Cong., Dec. 24, 2021, effective June 1, 2022), art. 40, 2022 P.R.C. LAWS 102.

199. Chao Feng, *Analysis on the Changes of National Disaster Prevention and Mitigation Policies Since 1978 in China*, 37 *J. CATASTROPHOLOGY* 29 (2022).

200. Water Law of the People’s Republic of China, *supra* note 168, art. 64.

201. Law of the People’s Republic of China on Desert Prevention and Transformation, *supra* note 174, art. 20.

grasslands.<sup>202</sup> Both norms create liabilities, but only the head or executor of the administrative authority is subject to “administrative sanctions.”<sup>203</sup>

As for private entities, relevant legislation guarantees few rights or benefits. In the normative stage, agricultural facilities, fish hatcheries, and other industries that are sensitive to the ecosystem<sup>204</sup> are often “absent.”<sup>205</sup> However, these industries are covered by ecological protection legislation, all of which consist of imperative or prohibitive norms.<sup>206</sup> Instructive and empowering norms that can mobilize the active and effective participation of private entities are seriously lacking.

Finally, the legal system includes procedural laws related to disaster-prevention management; emergency response and rescue; and recovery and reconstruction. With respect to existing environmental law norms, 54 pertain to comprehensive prevention and control, 85 relate to disaster prevention and early warning, 15 focus on disaster emergency relief, and 10 are dedicated to recovery and reconstruction.<sup>207</sup> Although this shows that disaster prevention is emphasized by the current risk-reduction framework, to date, the law has focused on single hazards and has not meaningfully considered multi-hazard-related risk.<sup>208</sup> Additionally, the “soft law” characteristics of these norms are apparent: only 24 provide a corresponding administrative punishment, just 4

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202. See *id.* art. 16 (“Except the felling for fostering and renewing, *no felling of trees may be approved on the anti-wind and sand-fixation forest nets and forest zones*. Before felling trees in the anti-wind and sand-fixation forest nets and forest zones for fostering and renewing, succeeding forest nets and forest zones must be formed near them. *No felling shall be approved on the anti-wind and sand fixation forest nets and forest zones* at the places where it is difficult to renew forests.”) (emphasis added); *id.* art. 20 (“The people’s governments at the county level or above of the places where the desertified lands are located *may not approve the cultivation of the edging zones of deserts and the forests and grasslands*; if they have already cultivated the lands and harmful effects have been done to the environment, the cultivated lands shall be restored to forests and grasslands in a planned and organized way.”) (emphasis added).

203. See *id.* art. 43 (“Under any of the following circumstances, the directly responsible personnel in-charge and other directly responsible personnel shall be given administrative punishments by their units, oversight departments or the administrative departments in charge at the higher level according to law . . . (2) in violation of the provisions of the second, third paragraphs of Article 16 of this Law, approving the felling of trees in the anti-wind and sand-fixation forest nets and forest zones; (3) in violation of the second, third paragraphs of Article 20 of this Law, approving the cultivation of the edging areas of deserts and forests, grasslands.”).

204. Joshua E. Cinner et al., *Potential Impacts of Climate Change on Agriculture and Fisheries Production in 72 Tropical Coastal Communities*, NATURE COMMUN., July 2022, at 1, 2.

205. There are very few environmental legal provisions that focus on peasants, fishermen and pastoralists, so the term “absent” is used to describe the absence of rights towards them.

206. See, e.g., Water Law of the People’s Republic of China, *supra* note 168, art. 40, (“It shall be prohibited to reclaim parts of a lake for use as farmland. Those already reclaimed shall be restored to the lake according to the state-prescribed flood prevention standards.”).

207. See discussion *supra* Table 2 (demonstrating the environmental procedural laws in place that deal with natural disasters).

208. Stefan Hochrainer-Stigler et al., *Toward a Framework for Systemic Multi-Hazard and Multi-Risk Assessment and Management*, ISCIENCE, May 2023, at 1, 4, <https://www.sciencedirect.com/science/article/pii/S2589004223008131/pdfft?md5=03397081db88290581db356e933d39bf&pid=1-s2.0-S2589004223008131-main.pdf>.

provide for administrative sanctions against the responsible government agents, and the remaining 127 paragraphs have no corresponding liability provisions.<sup>209</sup>

### III. THE CHALLENGES OF NATURE-BASED SOLUTIONS TO DISASTERS IN ENVIRONMENTAL LAW

To give full play to the use of NbS for disaster prevention in Chinese environmental law, the top priority should be to respect, utilize, and protect ecosystem services to the greatest extent.<sup>210</sup> In particular, the country should focus on regulating the most neglected services.<sup>211</sup> Then, because China is a civil law jurisdiction, a comprehensive legal system is needed to more effectively implement the currently disjointed framework of NbS for disaster risk reduction.<sup>212</sup> Lastly, China needs reasonable incentive and enforcement mechanisms to ensure the sustainability and extensiveness of NbS for disaster risk reduction,<sup>213</sup> specifically to convince all entities to implement reflective governance that draws on past experience to improve future environmental decision-making.<sup>214</sup> Current environmental law, which faces challenges like scattered legislation, incomplete systems, and the imbalance of rights, duties, and responsibilities, may well not meet these requirements.

#### A. Scattered Environmental and Natural Disaster Legislation

For a long time, environmental law has been governed by a reductionist approach, which, by ignoring the complexity and dynamics of the overall socio-ecological system, loses the forest for the trees.<sup>215</sup> Such an approach is likely to lead to a misunderstanding of the operation and nature of the system.<sup>216</sup> This reductionist approach has profoundly influenced the theory and practice of environmental law in China.<sup>217</sup> As Chinese environmental

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209. See discussion *supra* Table 2 (demonstrating the lack of accountability in the current legislation on disaster prevention).

210. Huang, *supra* note 125.

211. See VERCHICK, *supra* note 5, at 42 (explaining that neglecting ecosystems after a natural disaster can exacerbate subsequent environmental loss).

212. Yu & Mu, *supra* note 115, at 11.

213. Diana Dushkova & Dagmar Haase, *Not Simply Green: Nature-Based Solutions as a Concept and Practical Approach for Sustainability Studies and Planning Agendas in Cities*, LAND, Jan. 2020., at 1, 20.

214. Juliette G.C. Martin et al., *Catalyzing Innovation: Governance Enablers of Nature-Based Solutions*, SUSTAINABILITY, Feb. 2021, at 1, 2.

215. Klaus Bosselmann, *Losing the Forest for the Trees: Environmental Reductionism in the Law*, 2 SUSTAINABILITY 2424, 2431–33 (2010).

216. *Id.*

217. Lu Zhongmei, *Where Is the Road Back of Environmental Law? — Rethinking the Relationship Between Environmental Law and Traditional Sectoral Law*, 12 TSINGHUA UNIV. L.J. 6 (2018).

legal scholars have developed the theory of environmental law, the law has become aligned with the reductionism common to sectoral law; i.e., wherein “chickens and dogs hear each other, but cannot communicate with each other.”<sup>218</sup> This has resulted in the construction of a reductionist environmental legal system.<sup>219</sup>

Whether it is a pollution control law or a natural resources law, the focus is on a specific individual pollutant or natural resource.<sup>220</sup> If the legal system aims to advance the particular stability of just a single system, it risks harming all systems and contributing to the decline and collapse of both natural and human communities,<sup>221</sup> which naturally makes the laws structurally defective in the application of complex systems-based NbS. Per this reductionist view, environmental problems are rigidly categorized as either natural or human-caused,<sup>222</sup> and only the former are legally considered natural disasters. Additionally, the Law on Response to Emergencies, considered the “basic” Chinese emergency law, governs incidents involving public health, accident disasters, and social security risks.<sup>223</sup> Human-caused environmental problems, meanwhile, are considered either environmental pollution or ecological damage.<sup>224</sup> Based on this classification, the legal system seems clear and functional, but it meets challenges when asked to cope with systemic and complex natural disasters.

The characteristics of such fragmented legislation have led to various drawbacks in the context of environmental law for disaster risk reduction. First, such laws tend to lack comprehensive, integrated objective clauses or provisions laying out the law’s guiding principles. For example, as the “basic law,” the Environmental Protection Law only deals with disaster risk reduction regarding agricultural environmental protection.<sup>225</sup> On the other hand, within the natural resources legal system, the Water Law requires the

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218. *Id.*

219. *Id.*

220. Lu Zhongmei, *Thinking on the Research of Environmental Law in the New Era*, 4 J. CUPL 5 (2018).

221. Craig Anthony Arnold, *Environmental Law, Episode IV: A New Hope? Can Environmental Law Adapt for Resilient Communities and Ecosystems?*, 21 J. ENV’T & SUSTAINABILITY L. 1, 6 (2015).

222. This classification is widely used in Chinese environmental law textbooks. *See generally* JIN WANG, ENVIRONMENTAL LAW (Peking Univ. Press, 4th ed. 2018).

223. Yu An, *Implementation Issues of the Emergency Response Law*, 4 THEORETICAL HORIZON 44 (2009).

224. *See generally* WANG, *supra* note 222.

225. *See, e.g.*, Environmental Protection Law, *supra* note 182, art. 53 (“The people’s governments at all levels shall strengthen the protection of agricultural environment, promote the application of new technologies for protecting agricultural environment, strengthen the monitoring and early warning of agricultural pollution sources, and coordinate the relevant departments in adopting measures to prevent and control soil pollution, the desertification, alkalization, impoverishment and rocky desertification of land, land subsidence, vegetation deterioration, water loss and soil erosion, eutrophication of water bodies, exhaustion of water sources, extinction of species, and other ecological disturbances and promote the comprehensive prevention and control of plant diseases and insect pests.”).

“prevention and control” of water hazards and disasters in objective clauses.<sup>226</sup> This has resulted in the sustainable governance of the water-based environment, the consideration of water resources and water disasters during project development, and the utilization of prohibitive measures.<sup>227</sup> But as a rule, most natural resource legislation neglects to incorporate these objective or principle-based leading clauses.

Second, there exist serious legislative redundancies in reducing disaster risk. For instance, only the Law on the Prevention and Control of Environmental Pollution by Solid Waste and the Law on the Prevention and Control of Water Pollution prevent natural disasters, but all such laws aim to prohibit discharging, dumping, and accumulating pollutants.<sup>228</sup> At the same time, the Water Law, Yellow River Protection Law, and Flood Control Law contain provisions prohibiting the placement of objects that obstruct flood discharge.<sup>229</sup> Similarly, Fisheries Law, Land Management Law, and Mineral Resources Law also contain only one explicit regulation each, and these provisions all concern themselves with flood control.<sup>230</sup> Finally, Chinese environmental law related to NbS for disaster risk reduction lacks sufficiently effective communication and coordination mechanisms. While the law nominally includes many evaluation and assessment mechanisms—like environmental impact assessments, flood impact assessment reports, atmospheric environmental impact assessments, seismic safety assessments, and geological disaster risk assessments—their procedures, scopes, and effectiveness are so varied that they do not allow entities to address risks comprehensively.<sup>231</sup>

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226. Water Law of the People's Republic of China, *supra* note 168, arts. 1–2, 4, 10–11, 14.

227. Shen Baixin, *Chinese Sustainable Water Governance in the Perspective of Comparative Law*, 10 ENV'T & RES. L.R. 91 (2015).

228. Water Pollution Prevention and Control Law, *supra* note 188, art. 38; [Prevention and Control of Environment Pollution Law], art. 38, 2020 P.R.C. LAW 43.

229. Water Law of the People's Republic of China, *supra* note 168, art. 37; Yellow River Protection Law of the People's Republic of China, *supra* note 170, art. 67; Flood Control Law of the People's Republic of China, *supra* note 175.

230. *See generally* Yuye Fa (渔业法) [Law on Fisheries] (promulgated by the Standing Comm. Sixth Nat'l People's Cong., Jan. 20, 1986, rev'd Oct. 31, 2000, and Aug. 28, 2004), art. 40, 2004 P.R.C. LAWS; Tudi Guanli Fa (土地管理法) [Law on Land Administration] (promulgated by the Standing Comm. Sixth Nat'l People's Cong., June 25, 1986, rev'd Aug. 28, 2004), art. 22, 23, 2004 P.R.C. LAWS; Kuangchan Ziyuan Fa (矿产资源法) [Law on Mineral Resources] (promulgated by the Standing Comm. Sixth Nat'l People's Cong., Mar. 19, 1986, rev'd Aug. 29, 1996), art. 20, 1996 P.R.C. LAWS.

231. *See, e.g.*, Huanjing Yingxiang Pingjia Fa (环境影响评价法) [Environmental Impact Assessment Law] (promulgated by the Standing Comm. Ninth Nat'l People's Cong., Oct. 22, 2002), arts. 24, 28, 2003 P.R.C. LAWS (stipulating that environmental impact assessment occur at planning and construction projects where environmental pollution and ecological damage can take place); *see e.g.*, Fanghong Fa (防洪法) [Flood Control Law] (promulgated by the Standing Comm. Eighth Nat'l People's Cong., Aug. 19, 1997, rev'd Aug. 27, 2009, Apr. 24, 2015, and Jul. 2, 2016), art. 33, 2016 P.R.C. LAWS (stipulating that flood impact assessment reports be made for construction projects on flood plains and in flood storage



Recently, the country has indicated a willingness to discard the shackles of reductionism by formulating new types of legislation, such as the Yangtze River Protection Law, based on a holistic and systematic approach.<sup>232</sup> However, the prevailing environmental legal worldview remains a reductionist one, such that the ecosystem-based approach has not been fully reflected and implemented in Chinese environmental legislation.<sup>233</sup> In sum, reductionist legislative thinking has rendered the country's environmental legal system fragmented and ineffective for disaster prevention and mitigation.

### *B. Incomplete Interaction Between Environmental Science and Legal System*

The incomplete interaction between the ecosystem and legal system is reflected not only in the legislature's disregard for certain disaster risks but also in its insufficient discussion of certain forms of ecosystem services. In terms of the robustness of environmental legislation, although 27 pieces of legislation are devoted to different kinds of disaster prevention and mitigation,<sup>234</sup> there are still many forms of natural disaster that urgently require more attention from environmental law. For example, because of the intensification of climate change and resulting sea level rise, marine disasters are becoming more frequent. Even so, the Marine Environmental Protection Law, Island Protection Law, and Marine Utilization and Management Law do not call for the restoration of mangroves, salt algae lands, coral reefs, or sand dunes for reducing hurricanes, storm surges, floods, and other marine disasters.<sup>235</sup> Only Article 40 of the newly promulgated Wetland Conservation Law requires mangrove wetland restoration to prevent marine disaster risk.<sup>236</sup>

Simultaneously, the law's consideration of ecosystem function with respect to the pre-disaster, disaster, and post-disaster stages is insufficient. For example, the Forest Law mandates the prevention and control of soil erosion, fire, and biological disasters, but the two latter categories do not

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areas); *see, e.g.*, Qixiang Fa (气象法)[Meteorological Law] (promulgated by the Standing Comm. Ninth Nat'l People's Cong., Oct. 31, 1999), art. 34, 2000 P.R.C. LAWS (stipulating that authorities at all levels shall organize atmospheric environmental impact assessments for urban planning, key national construction projects, and major regional economic development projects); *see, e.g.*, Dizhi Zaihai Fangzhi Tiaoli (地质灾害防治条例)[Regulations on Prevention and Control of Geological Disasters] (promulgated by the Standing Comm. Ninth Nat'l People's Cong., Nov. 19, 2003), art. 21, 2004 P.R.C. LAWS (stipulating that geologic-hazard risk assessments shall be conducted for planning and construction areas).

232. Lu, *supra* note 143, at 79.

233. Gong Gu, *Environmental Codification from the Perspective of the Ecosystem Approach: Direction and Ideas*, RULE L. RSCH., Issue No. 3, 2023, at 49.

234. *See* discussion *supra* Table 2 (summarizing Chinese law aimed at disaster prevention).

235. *Id.*

236. Wetlands Conservation Law, *supra* note 198, art. 40.

account for certain functions of forest ecosystems. These types of disasters can mitigate floods and droughts and reduce and prevent landslides, debris flows, avalanches, and other hydrological and geological disasters.<sup>237</sup> In the context of disaster prevention and mitigation, planning solely for post-disaster recovery is never sufficient.

Provisions accounting for pre-disaster prevention are the most numerous, but they tend to be narrow, focusing on the prevention of existing, definite, and individual disasters.<sup>238</sup> As a result, the role of environmental law in the emergency and recovery phases is perceived as short-term, largely ignoring the prospects for long-term recovery.<sup>239</sup> Emergency relief and rehabilitation directly affect the adaptation and transformation capacity of disaster-stricken areas.<sup>240</sup> As climate change intensifies, the likelihood of potential risks rapidly increases. Typically, the resilience indicators for disaster-affected areas include poverty reduction, sustainability, and multiple social and environmental stressors, which form a non-linear and complex relationship.<sup>241</sup> Therefore, transforming the socio-ecological system into an adaptive one requires environmental law to play a more substantial role in post-disaster emergency assistance and recovery.

### *C. Imbalance of Rights, Duties, and Responsibilities*

The effectiveness of disaster risk reduction functions depends on the balance of clear rights, duties, and responsibilities.<sup>242</sup> In the process of bolstering NbS for disaster risk reduction, it is essential to involve various stakeholders.<sup>243</sup> This requires incentivizing and safeguarding behaviors that actively promote EbA-DRR or improve environmental management. Alternatively, legislation could seek to punish or restrict actions that cause or exacerbate environmental disasters. However, China's current environmental regulations are deficient in both areas.

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237. INTECHOPEN, PROTECTIVE FORESTS AS ECOSYSTEM-BASED SOLUTION FOR DISASTER RISK REDUCTION (ECO-DRR), at xiii–xiv (Michaela Teich et al. eds., 2022).

238. Wetlands Conservation Law, *supra* note 198, art. 40.

239. Melissa L. Finucane et al., *Short-Term Solutions to a Long-Term Challenge: Rethinking Disaster Recovery Planning to Reduce Vulnerabilities and Inequities*, 17 INT'L J. ENV'T RSCH. & PUB. HEALTH 482, 485 (2020).

240. *Id.*

241. See Nathan L. Engle et al., *Towards a Resilience Indicator Framework for Making Climate-Change Adaptation Decisions*, 19 MITIGATION & ADAPTATION STRATEGIES GLOB. CHANGE 1295 (2014) (explaining that non-linear and complex relationship focuses on interactions between social and ecological systems, including processes and feedbacks at various scales).

242. Xue-Song Liu, *A New Construction of Effective Disaster Prevention and Reduction From Disaster Community to Responsibility and Ethics Community*, 16 J. NAT. DISASTERS 148, 148 (2007).

243. Carl C. Anderson & Fabrice G. Renaud, *A Review of Public Acceptance of Nature-Based Solutions: The 'Why,' 'When,' and 'How' of Success for Disaster Risk Reduction Measures*, 50 AMBIO 1552, 1553 (2021).

In terms of incentive and safeguard mechanisms, there are no empowering norms actively encouraging private entities to engage in environmental and ecological disaster reduction. In addition, direct incentives related to financial, tax, or policy benefits are limited.<sup>244</sup> The existing responsibility framework mainly targets administrative liabilities for enterprises, institutions, or individuals violating prohibitive norms.<sup>245</sup> But numerous norms setting out both roles and responsibilities of the government and its administrative agencies lack corresponding legal consequences and accompanying accountability measures.<sup>246</sup> Moreover, the traditional perception of natural disasters as *force majeure*<sup>247</sup> and the historical exemption of state responsibility have led to an incongruity between the expansion of government disaster management powers and the simultaneous narrowing of accountability.<sup>248</sup> This misalignment makes it difficult to comprehensively constrain situations in which the government is idle or acts improperly in the realms of ecological protection, restoration, and disaster prevention and mitigation.<sup>249</sup>

#### IV. MAINSTREAMING NATURE-BASED SOLUTIONS TO DISASTERS INTO THE ENVIRONMENTAL LEGAL CODE

Disaster risk reduction requires the collaborative governance of various legal sectors, including environmental, disaster, and social security law.<sup>250</sup> China's environmental law is currently undergoing a paradigm transformation towards ecosystem-based governance.<sup>251</sup> Ensuring disaster regulation as one of the ecosystem services would be a natural progression. However, to address the fragmented and weak implementation of disaster prevention and mitigation norms within existing environmental law, a

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244. For instance, only Article 25 of the Law on Desert Prevention and Transformation explicitly offers policy benefits to land users and leaseholders who took measures such as afforestation, reforestation, or land closure to combat desertification. See Law of the People's Republic of China on Desert Prevention and Transformation, *supra* note 174, art. 25.

245. See discussion *supra* Table 2 (highlighting 108 instances of compound norms involving authority and responsibilities).

246. See discussion *supra* Table 2 (demonstrating that only four of the 108 instances of compound norms contain administrative penalties).

247. *Force majeure* is a clause that is included in contracts to remove liability for unforeseeable and unavoidable catastrophes that interrupt the expected course of events and prevent participants from fulfilling obligations. These clauses generally cover natural disasters, such as hurricanes, tornadoes, and earthquakes, as well as human actions, such as armed conflict and man-made diseases.

248. Du Qun & Huang Zhiyu, *On the National Tort Liability for Inaction in Natural Disaster Management*, 15 J. CHINA UNIV. GEOSCIENCES (SOC. SCI. EDITION) 37 (2015).

249. *Id.*

250. See Farber & Faure, *supra* note 2, at xv (explaining that "the interdependencies between different forms of risk management" require collaboration between categories of risk management).

251. Gu Gong, *Legal Needs and Legal Expression of the Overall Management of Mountains, Rivers, Forests, Farmland, Lakes, Grass and Sand*, ORIENTAL L., 2022, Issue 1, at 108.

systematic update and improvement is necessary. The compilation of the Ecological Environment Code provides a significant opportunity.

*A. The Draft Code Responses to Disaster Risk Reduction*

1. General Plan

Since 2017, the Environmental and Resources Law Research Association of the China Law Society has compiled research for an Ecological Environment Code.<sup>252</sup> Nearly 200 scholars and practitioners have participated in the different forms of research.<sup>253</sup> The project has completed three sub-projects: “Translation of Foreign Environmental Codes,” “Fundamental Theoretical Research on Environmental Code Compilation,” and “Research on Expert Proposed Draft of the Ecological and Environmental Code.”<sup>254</sup> This effort has culminated in the translation and publication of environmental codes from nine countries, five monographs, and the “Expert Proposed Draft of the Ecological and Environmental Code.”<sup>255</sup> Through a substantive and moderate approach that combines both “compilation” and “codification,” a comprehensive system of norms has been established. The norms consist of five sections—General Provisions, Pollution Control, Natural Ecological Conservation, Green and Low-Carbon Development, and Ecological and Environmental Responsibility<sup>256</sup>—spanning 36 chapters and encompassing more than 1,100 provisions.<sup>257</sup>

The realization of disaster prevention and mitigation functions in environmental law depends on two indispensable mechanisms: environmental management measures and the ecosystem-based approach.<sup>258</sup> The extent to which an environmental code responds to disaster prevention and mitigation depends on two key facts: (1) the relationship between different environmental statutes and disaster risk reduction; and (2) whether pre-existing laws are repealed after codification.<sup>259</sup> From the above analysis, it is evident that ecological protection statutes are the most closely related to

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252. Lu Zhongmei, *Ten-Year Review of Environmental Rule of Law Construction and Prospects for Environmental Codification*, 36 J. BEIJING UNIV. (SOC. SCI. EDITION) 18 (2023).

253. *Id.*

254. *Id.*

255. *Id.*

256. Diao Fanchao, *Lu Zhongmei: The Motion to Initiate the Compilation of the Ecological and Environmental Code Has Been Fully Adopted*, PAPER: GREEN POL’Y OFF. (Mar. 6, 2024), [https://www.thepaper.cn/newsDetail\\_forward\\_26572769](https://www.thepaper.cn/newsDetail_forward_26572769).

257. *Id.*

258. ECOSYSTEM APPROACH TO DISASTER RISK REDUCTION, *supra* note 69, at 29.

259. The “moderate codification model” is a typology of existing environmental laws based on the value of sustainable development and the concept of ecological environment, then decide whether to include it in the Code. *See* Fanchao, *supra* note 256.

disaster risk reduction, and the relationship has been collaboratively governed at both the legislative and practical levels. However, the “ecological” provisions of the natural resources law will be repealed upon enactment of the Code.<sup>260</sup> Therefore, the disaster prevention and mitigation provisions within the natural resources law should be thoroughly integrated and refined within the Code to comprehensively respond to disaster prevention and mitigation in the book of Natural Ecological Protection.<sup>261</sup> These pollution control statutes mainly focus on the exposure of pollutants in the face of disasters and the emergency treatment of resulting pollution. These statutes will also be abolished after the Code.<sup>262</sup> The disaster prevention and mitigation provisions therein should also be comprehensively integrated and addressed within the Code. The correlation between green and low-carbon development and disaster risk reduction is weaker, but it is important to analyze if and how these two aspects can be effectively aligned to enhance disaster resilience.<sup>263</sup> Adding disaster risk reduction functions to the Ecological and Environmental Code depends upon harmonizing legal norms and integrating them into the Code’s comprehensive framework.

## 2. Specific Responses

Compared with existing norms, the Expert Proposed Draft of the Ecological and Environmental Code (Draft Code) demonstrates both progress and shortcomings in responding to disaster risk reduction functions. The areas of progress can be highlighted as follows. First, the Draft Code deserves praise for identifying common elements related to disaster risk reduction. For example, measures related to disaster emergency monitoring and contingency planning collected from laws such as the Water Pollution Prevention and Control Law, the Soil Pollution Prevention and Control Law, the Water Law, and the Forestry Law have been incorporated into the basic framework of the General Provisions under the Ecological and Environmental Emergency Management System (EEMS).<sup>264</sup> This integration combines disaster emergency response with environmental emergency response, enabling an effective response to the environmental hazards of

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260. *Id.*

261. Gu Gong, *Conception of the Nature and Ecological of the Environmental Code*, 40 *SCI. L.* 96, (2022).

262. Jin Wang, *The Construction and Innovation of the Framework of China’s Environmental Code-Lessons from the Framework of the Chinese Civil Code*, 35 *CONTEMPORARY L. REV.* 18 (2021).

263. See generally Frauke Urban et al., *Issues at the Interface of Disaster Risk Management and Low-Carbon Development*, 3 *CLIMATE & DEV.* 259, 270 (2011) (supporting the proposition that low-carbon technology development and disaster risk management is weak in the short-term but still a necessary consideration).

264. Xiaoran Zhou, *On the Establishment Principles for Basic Systems in General Provisions of Environmental Code*, 4 *J. SOOCHOW UNIV.* 42 (2021).

disasters and the disaster risks posed by environmental issues, thus improving the disaster response capacity of the socio-ecological system.<sup>265</sup> Second, the Draft Code establishes the concept of “integrated ecosystem management” to coordinate and implement the approach from the book of *Natural Ecological Conservation*.<sup>266</sup> This approach, which follows principles of systems thinking, adaptability, region-specific management, public participation, scientific decision-making, and dynamic adaptation, provides a solid foundation for ecosystem-based disaster risk reduction.<sup>267</sup> Third, the Draft Code attempts to uniformly address the disparate sources of ecosystem degradation.<sup>268</sup> The chapter on “Prevention and Control of Natural Ecosystem Degradation” systematically addresses ecological environmental disasters, such as soil erosion and land desertification. Existing laws boast similar chapters, including the Water Law, Forest Law, Grassland Law, Soil and Water Conservation Law, and Desertification Control Law.<sup>269</sup> Finally, in the Green and Low-Carbon Development section, the Draft Code seeks to establish a monitoring, prediction, and early-warning mechanism for climate disasters.<sup>270</sup> This inclusion integrates climate-change risk management into the disaster risk reduction framework, providing a critical response to the increasing frequency of climate-related disasters.<sup>271</sup>

### 3. Potential Shortcomings

While there is progress in these areas, it is also important to acknowledge the potential shortcomings in the Draft Code and to continue refining it. By doing so, we can incorporate comprehensive and effective disaster prevention and mitigation measures into the final version of the Ecological Environment Code.

For example, the Draft Code not only fails to solve the existing inadequacies in the comprehensive regulatory framework of environmental laws for disaster risk reduction—including issues of imbalance to rights and responsibilities and the incompleteness of the legal system—but also fails to incorporate existing disaster-prevention and -mitigation norms. Furthermore, there has been insufficient discussion on post-codification disposal plans, which undoubtedly weakens the disaster-prevention and -mitigation

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265. See generally Birutė Pitrenaitė-Žilėnienė et al., *Enhancing Resilience Against Disasters: Engaging the Public via Social Technologies*, 4 *SOCIALINĖS TECHNOLOGIJOS* 318, 318–32 (2014) (supporting integration of different legal propositions that enhance disaster response and resilience).

266. Gong, *supra* note 261.

267. *Id.*

268. *Id.*

269. *Id.*

270. Zhongmei Zhang, *The Contributions Made by the Green and Low-Carbon Development Chapter of the Environmental Code to Sustainable Development*, 40 *SCI. L.* 87 (2022).

271. *Id.*

functions of the Draft Code. For example, the Water Law—along with its legislative purposes, fundamental principles, planning guidelines, monitoring systems, regulations on water use, hydropower, river management, water-engineering facilities, and various prohibitive and restrictive measures to prevent and control hydrological disasters—has not been included.

Although the Code adopted limited and moderate “ecological” codification, those regulations should be modified rather than discarded.<sup>272</sup> These regulatory provisions on disaster risk reduction properly fall within the scope of the “ecological” aspect and should not be deleted. Even though the existing Draft Code establishes an ecosystem-based approach; dedicates specific chapters to develop disaster prevention and control systems; and provides additional conceptual, methodological, and institutional support for EbA-DRR, it ignores the specific mitigating functions of particular ecosystems.<sup>273</sup> This omission may result in challenges to the effective implementation of the ecosystem approach or in the approach being implemented incompletely.

### *B. Systematic Approaches*

#### 1. Further Clarifying the Applicability of Nature-Based Solutions for Disasters

Although the Draft Code establishes the ecosystem approach,<sup>274</sup> it does not explicitly define the proper scope of that approach. This scope should be clarified in the final Code. Relevant legal frameworks should be required to rationally utilize natural resources, implement environmental governance, and mitigate risks at an ecosystem level. This not only safeguards environmental and ecosystem health and helps reduce the occurrence of disasters and their impacts, but also improves societal and individual adaptability.<sup>275</sup> Apart from helping distinguish environmental law from disaster law, focusing on short-term recovery helps shift the focus to long-term ecosystem resilience after natural disasters. Short-term solutions help socio-ecological systems that are vulnerable to disasters better cope with future disasters.<sup>276</sup>

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272. Fanchao, *supra* note 256.

273. Gong, *supra* note 261.

274. Gong, *supra* note 233.

275. Colin G. Harrison & Peter R. Williams, *A Systems Approach to Natural Disaster Resilience*, 65 SIMULATION MODELLING PRACTICE & THEORY 11, 19 (2016).

276. Morgan Drake, *Federal Environmental Exemptions for Natural Disasters and the Case for Ecosystem Resilience*, 34 BYU J. PUB. L. 109, 110 (2019).

Though the ecosystem approach inherently provides regulating and buffering functions for humanity on a scientific level, its establishment in legal frameworks does not automatically confer disaster-prevention-and-mitigation capabilities to environmental law. This is partly because the ecosystem approach faces controversies, uncertainties, and complexities with respect to theoretical frameworks, methodologies, and practical applications.<sup>277</sup> Additionally, these legal norms require clarity, without which the ecosystem approach may not as effectively guide government compliance. The necessity of reconciling conflicts of interest is also evident as different actors compete for ecosystem service functions, presenting intricate narratives of competition and interests,<sup>278</sup> including competing ecological interests.<sup>279</sup> Without explicit delineation of the scope, it is difficult to arrange specific systems for implementation, potentially neglecting disaster-regulating functions.<sup>280</sup> Hence, although establishing the ecosystem approach serves as a foundation, clarifying its applicability in the field of disaster risk reduction serves two purposes.<sup>281</sup> On one hand, the ecosystem approach acts as a directive for specific environmental legal systems in managing disaster risks.<sup>282</sup> On the other, it acts as a “bridging clause” between environmental law and disaster law, providing a normative basis for their collaborative governance.<sup>283</sup>

## 2. Systemic Convergence of Integrated Risk Governance

Once the provisions pertaining to the ecosystem approach and its areas of application have been established in the Code, further steps are required to comprehensively rectify the existing inadequacies. First, the state must meticulously review and rectify the existing draft proposal from environmental law experts, incorporating any omitted disaster-risk-reduction norms into their respective chapters. Then, for the existing legislative gaps or incomplete regulations related to marine and biological disasters, the state

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277. Vito De Lucia, *Competing Narratives and Complex Genealogies: The Ecosystem Approach in International Environmental Law*, 27 J. ENV'T L. 91, 93 (2015).

278. Lars Hein et al., *Spatial Scales, Stakeholders and the Valuation of Ecosystem Services*, 57 ECOLOGICAL ECON. 209, 224 (2006).

279. Volker Mauerhofer, *The Law, Ecosystem Services and Ecosystem Functions: An In-Depth Overview of Coverage and Interrelation*, 29 ECOSYSTEM SERVS. 190, 195 (2018).

280. VERCHICK, *supra* note 5, at 81.

281. Adam W. Whelchel et al., *Advancing Ecosystems and Disaster Risk Reduction in Policy, Planning, Implementation, and Management*, INT'L J. DISASTER RISK REDUCTION, Dec. 2018, at 1, 1.

282. Jacqueline Peel & David Fisher, *International Law at the Intersection of Environmental Protection and Disaster Risk Reduction*, in THE ROLE OF INTERNATIONAL ENVIRONMENTAL LAW IN DISASTER RISK REDUCTION 1, 9 (Jacqueline Peel & David Fisher eds., 2016).

283. See Farber, *supra* note 76, at 1786 (noting that appropriate legal guidance can ensure that disasters are anticipated and contained in a comprehensive and equitable manner). Farber does not directly discuss the ecosystem approach as a tool for integrating environmental law and disaster law.



should employ a process of consolidation to supplement and enhance these regulations. The state should then seamlessly integrate these provisions into various chapters of the Natural Ecosystem Conservation section,<sup>284</sup> thus forming a comprehensive and scientifically sound regulatory framework. Next, it will be crucial to expand the scope of disaster risk management, thereby reinforcing the disaster-risk-prevention capabilities of environmental law.<sup>285</sup> The ecosystem approach, which uses scientific, adaptive management to address the complexity and dynamism of ecosystems, requires a risk-preventive stance while respecting the limits of ecosystem functionality.<sup>286</sup> Therefore, the state should expand the existing, reductionist role of mitigating singular disaster losses within environmental law by bolstering the law's preventive governance capacity to first identify potential disaster risks and then take proactive measures to prevent them. To achieve this, the existing environmental impact assessment (EIA) system should be expanded to encompass natural disaster risks.<sup>287</sup> This could be achieved by broadening the scope of the requisite assessment to include natural disaster risks in coordination with existing regulations, such as EIAs, geological hazard assessments, and seismic safety evaluations. Finally, regulations or departmental rules pertaining to the planning and construction EIAs should be modified and enhanced.<sup>288</sup>

Identifying, assessing, and preventing disaster risks could be achieved through the following three key steps. First, planners should incorporate risk into development planning by conducting EIAs for development projects (such as dam construction and ecological restoration projects). This would reduce or prevent the construction of communities and infrastructure in vulnerable areas.<sup>289</sup> For instance, such an assessment would need to consider how proposed deforestation activities could impact local landslide or flood risks. Second, integrating EIAs fully into post-disaster activities helps

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284. Gu Gong recommends that the Natural Ecosystem Conservation section of the Code be structured into ten chapters: Chapter 1 General Provisions; Chapter 2 Nature Conservation Planning; Chapter 3 Nature Conservation Zoning; Chapter 4 Nature Conservation Information; Chapter 5 Control and Conservation of Ecological Elements Utilization; Chapter 6 Ecological Regional Conservation; Chapter 7 Nature Conservation Sites; Chapter 8 Species and Genetic Diversity Conservation; Chapter 9 Nature Ecological Degradation Prevention, Control and Improvement; and Chapter 10 Nature Ecological Conservation Funding and Benefits. Gong, *supra* note 261.

285. *Id.*

286. Elisa Morgera, *The Ecosystem Approach and the Precautionary Principle*, 3 ENCYCL. ENV'T L. 70, 74, 75 (2017).

287. See ECOSYSTEM APPROACH TO DISASTER RISK REDUCTION, *supra* note 69, at 163–84 (exploring EIAs as a policy-planning tool for natural disaster risk management).

288. See *id.* at 168 (illustrating the potential scope of EIAs in risk management).

289. See Yung-Jaan Lee, *Social Vulnerability Indicators as a Sustainable Planning Tool*, 44 ENV'T IMPACT ASSESSMENT REV. 31, 31 (2014) (“[A] focus on social vulnerability moves hazard research towards a more comprehensive and humanistic framework . . . as this framework considers the underlying but less visible factors that exacerbate the effects of . . . hazards.”).

prevent the recurrence of disasters and promotes sustainable development.<sup>290</sup> Third, engaging with and soliciting input from the public, especially vulnerable communities, during the EIA process ensures that disaster-prevention-and-mitigation measures align with local ecological and developmental needs.<sup>291</sup> Especially as natural disasters become more frequent and severe due to climate change, expanding environmental law's capability to prevent and mitigate disaster requires entities to consider climate change's impact on such measures. Accordingly, measures must be taken to adapt to climate change and prevent future disaster risks.

### 3. Enhancing Incentives and Constraints for Equal Rights and Responsibilities

To actively reduce disaster risk by implementing actions that protect and restore ecosystems, the Code could integrate incentive mechanisms into various aspects of ecological environmental protection. These include economic, honor, and authorization incentives.<sup>292</sup> This integration ensures the sustainability and widespread adoption of such actions. Economic and honor incentives can be incorporated into the general provisions of the Guarantee and Guidance Mechanism section by “bringing together extracted and abstracted generalities.”<sup>293</sup> Authorization incentives should be explicitly defined in the general provisions of the Ecological Environment Code to grant rights to enterprises, institutions, and the public for ecological protection and restoration.<sup>294</sup>

The maxim “one side suffering, all sides supporting” represents national cohesion, which forms the basis of a “disaster community.”<sup>295</sup> However, as humanity's impact on the natural environment deepens, especially with respect to the intensifying effects of climate change, natural disasters can no longer be regarded solely as a *force majeure*.<sup>296</sup> The disaster-prevention and

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290. Thomas B. Fischer, *Disaster and Risk Management: The Role of Environmental Assessment*, J. ENV'T ASSESSMENT POL'Y & MGMT., Sept. 2014, at 1, 1.

291. See Kevin Alden, Note, *Extending NEPA to Address Disaster Mitigation*, 35 BYU J. PUB. L. 129, 132 (2020) (explaining how the U.S.'s National Environmental Policy Act requires public input at the environmental assessment stage).

292. See Annisa Triyanti & Eric Chu, *A Survey of Governance Approaches to Ecosystem-Based Disaster Risk Reduction: Current Gaps and Future Directions*, 32 INT'L J. DISASTER RISK REDUCTION 11 (2018) (explaining how incentives can be used for ecosystem conservation), [https://pure-oai.bham.ac.uk/ws/files/45176689/IJDRR\\_Unedited\\_Proof.pdf](https://pure-oai.bham.ac.uk/ws/files/45176689/IJDRR_Unedited_Proof.pdf).

293. The Code is based on the Pendleton system's legislative technique of “bringing together extracted and abstracted generalities.” Fanchao, *supra* note 256.

294. *Id.*

295. Liu, *supra* note 242.

296. See Kristian Cedervall Lauta, *New Fault Lines? On Responsibility and Disasters*, 5 EUR. J. RISK REGUL. 137, 137 (2014) (“[A]s disasters increasingly come to be understood through the affected society's vulnerabilities, what previously was considered horrible misfortunes become potential injustices instead—thereby resulting in an increased need for legal processes.”).

disaster-mitigation regulations in environmental law should gradually transition away from their “soft law” nature, challenging the prevailing trend of privatizing and internalizing responsibility and moving towards creating a “responsibility community” out of the disaster community.<sup>297</sup> In the context of natural disasters, the government and its administrative bodies play a leading role in prevention, emergency response, and management.<sup>298</sup> Consequently, these entities should enhance the review, constraint, and accountability of decisions regarding consideration of natural disaster risks.

Including so-called responsibility clauses would encourage various entities to reflect on past experiences and improve on future environmental decisions. Such clauses would help to address the issue of imbalanced rights and responsibilities. Additionally, incorporating causative-liability clauses into the code—when paired with legal liability systems for natural disaster prevention and control—could enhance the effectiveness of accountability mechanisms. Adopting these measures establishes a comprehensive legal framework that could not only incentivize ecological protection and disaster risk reduction but also enforce accountability for decision-making in the face of natural disasters.<sup>299</sup>

#### CONCLUSION

Constructing an ecological civilization in China requires innovation within the legal system and, consequently, the improvement of existing legal mechanisms and the creation of new ones. Compiling the Ecological Environment Code provides a favorable approach and is a valuable opportunity for achieving these goals.<sup>300</sup> Synergizing the framework for nature-based solutions to disaster risk reduction is essential; although a loose framework governing risk reduction exists, it remains underdeveloped and deserves more thorough attention. This Article serves as an initial exploration of these ideas, inviting further discussion and insights from experts in the field.

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297. Liu, *supra* note 242.

298. Zhiyu Huang, *The Study of Right-Based Approach to Disaster Prevention and Mitigation*, 2 LEGAL F. 125 (2018).

299. See Michael G. Faure, *In the Aftermath of the Disaster: Liability and Compensation Mechanisms as Tools to Reduce Disaster Risks*, 52 STAN. J. INT'L L. 95, 157 (2016) (explaining that liability regimes can create “better incentives for disaster risk mitigation by avoiding channeling legal liability”).

300. Fanchao, *supra* note 256.