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## **Introduction** <sup>(1)</sup>:

Habitat loss refers to the reduction in the amount of space where a particular species, or group of species can survive and reproduce. Habitat loss is a consequence of human activities such as agriculture, urbanization, deforestation, resource extraction, alteration of the sea-floor due to trawling (fishing), or the release of pollutants. Habitat loss can also occur due to environmental changes, such as volcanic eruptions or tsunamis, or changes in climate or sea level, which today are largely the result of human activities. Habitat loss can decrease biodiversity and alters species ranges and interactions.

Humans have altered Earth's land for thousands of years, but industrialization and population growth over the last 300 years, and especially over the last 70 years, has led to a great expansion in our land use and disturbance of habitats worldwide.

Habitat restoration is the purposeful rehabilitation of an area to recreate a functioning ecosystem. Successful habitat restoration requires understanding species life cycles and interactions, and the food, water, nutrients, space, and shelter that is necessary to sustain species populations. When habitats cannot be restored to their original size or condition, land can be set aside that connects open spaces and habitats, called wildlife corridors, that allow species to survive in and around areas occupied by humans. For example, marshes are important resting spots for migratory birds, bridges allow animals to cross highways, and protected creek habitats create space for plants and animals even within developed areas.

Habitat loss and restoration impact the Earth system in a variety of ways, including:

- Species populations, ranges, biodiversity, and the interactions of organisms. Habitat loss can fragment ecosystems and can cause species extinctions, while habitat restoration can increase local biodiversity and species populations.
- The evolution of life cycles and traits that help species survive and reproduce in disturbed or altered ecosystems. For example, some bird species living in urban environments have altered their beak shape to be able to more effectively eat the seeds in human-made bird feeders.
- Alter soil quality. Habitat loss, especially removal of plants and trees which stabilize soil, increases erosion, and reduces the nutrient levels in terrestrial ecosystems. This, in turn, can decrease agricultural productivity. In turn, increasing

erosion decreases water quality by increasing sediment and pollutants in rivers and streams.

- How much and how fast water cycles through the biosphere and atmosphere. Trees and plants return a significant proportion of precipitation to the atmosphere via a process called transpiration. Thus, loss of plant productivity and biomass decreases the amount of water cycling through the biosphere and atmosphere, while increasing plant productivity and biomass increase the amount of water cycling.
- Impact how coastal regions will be affected by sea level rise. Marshes and swamps protect coastlines by reducing coastal erosion and by promoting sedimentation. These habitats increase the resilience of coastal regions to sea level rise, especially storm surges.

This annotated bibliography aims to assist the Environment and Life Sciences Research Center ELRSC, mainly the Desert Agriculture and Ecosystems Program (DAE) program, by providing articles examining local strategies to oversee the implementation of plans to repair environmental damage with the goal of conserving biodiversity and enhancing greenery sustainably.

This annotated bibliography contains articles abstracts from 2022-2024.

E-resources used: Scopus.

**Contact NSTIC to request full-text articles**

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(1) Habitat loss / restoration (n.d.). Retrieved Dec. 3, 2023, from <https://ugc.berkeley.edu/background-content/habitat-loss-restoration/#:~:text=Habitat%20restoration%20is%20the%20purposeful,necessary%20to%20sustain%20species%20populations.>

### **Articles Abstracts:**

1. Abdul Wahab, M. A., Ferguson, S., Snekkevik, V. K., McCutchan, G., Jeong, S., Severati, A., Randall, C. J., Negri, A. P., & Diaz-Pulido, G. (2023). Hierarchical settlement behaviours of coral larvae to common coralline algae. *Scientific Reports*, 13(1)

**Abstracts:** Natural regeneration of degraded reefs relies on the recruitment of larvae to restore populations. Intervention strategies are being developed to enhance this process through aquaculture production of coral larvae and their deployment as spat. Larval settlement relies on cues associated with crustose coralline algae (CCA) that are known to induce attachment and metamorphosis. To understand processes underpinning recruitment, we tested larval settlement responses of 15 coral species, to 15 species of CCA from the Great Barrier Reef (GBR). CCA in the family Lithophyllaceae were overall the best inducer across most coral species, with *Titanoderma* cf. *tessellatum* being the most effective species that induced at least 50% settlement in 14 of the coral species (mean 81%). Taxonomic level associations were found, with species of *Porolithon* inducing high settlement in the genus *Acropora*; while a previously understudied CCA, *Sporolithon* sp., was a strong inducer for the *Lobophyllidae*. Habitat-specific associations were detected, with CCA collected from similar light environment as the coral inducing higher levels of settlement. This study revealed the intimate relationships between coral larvae and CCA and provides optimal coral-algal species pairings that could be utilized to increase the success of larval settlement to generate healthy spat for reef restoration. © 2023, Crown.

2. Bavarsad, F. S., Attarroshan, S., & Orak, N. (2023). Assessment of fire history effects on the plant diversity and regeneration of woody species in *Ziziphus spina-christi* (L.) Willd. forests in HaftShahidan protected area. *Acta Ecologica Sinica*, 43(6), 968-976.

**Abstracts:** Due to the important role of plant species diversity and its conservation, few biodiversity studies have been conducted in tropical forests. In the present study, which was carried out in the HaftShahidan protected area of Khuzestan, the characteristics of the vegetation in five forest habitats include areas one, two, four, eight years after fire and control area were investigated. To conduct this study, the linear transect method with specific distances of 200 m in a specific east-west direction was used, then 50 sample plots with distances of 100 m from each other were dismantled toward the transects. The area of the sample plots was considered based on the size of the proposed sample plot to study the temperate to tropical

forest cover (20 × 20 m). Canopy measurements for wood species (trees and shrubs) were measured at a plot of 400 m<sup>2</sup>. Also, this measurement was executed for herbaceous species in 3.2 m<sup>2</sup> micro-plots that were selectively dismantled in groups of 4 (clusters) at 5 points from the surface of the sample plot. The main objectives of this study were to investigate the biodiversity, floristic characteristics, and vegetation in the control forest as a model of optimal conditions and comparison with other habitats. The study of plant species diversity between the studied treatments showed that fire can increase the richness, evenness and finally the species diversity in vegetation. It should be noted that the increase in the values of the indicators reached to the maximum after two years of the fire. The results also showed that the seedling regeneration rate of *Ziziphus spina-christi* (L.) Willd. tree species decreased sharply after the fire and in contrast, seedling regenerations showed an increasing trend. Finally, it can be noted that the restoration of degraded tropical forest habitats is not possible only based on biodiversity conservation in the short period after the fire, and such results will be possible after a long period of time. © 2023 Ecological Society of China

3. Brooks, G. C., Gorman, T. A., Jones, K. C., Chandler, H. C., Rincon, B. K., Sisson, M. A., Himes, J., & Haas, C. A. (2023). Removing duff layers in fire-suppressed wetlands can aid habitat restoration efforts. *Wetlands*, 43(8)

**Abstracts:** Amphibians breeding in ephemeral wetlands within pine-dominated (*Pinus* spp.) natural communities are less likely to persist in wetlands that have developed high canopy cover and low herbaceous groundcover in the absence of regular plant growing-season wildfires. The reintroduction of historic fire regimes, in conjunction with mechanical or herbicide removal of woody shrubs, can reduce the woody midstory in wetlands. However, certain conditions can hinder the reemergence of herbaceous groundcover in degraded wetlands even after the removal of the woody midstory. After four years of no discernible recovery of herbaceous vegetation at two Reticulated Flatwoods Salamander (*Ambystoma bishopi*) breeding wetlands, we conducted a duff-removal experiment to test whether duff accumulation was preventing herbaceous plant germination and growth. Using a paired design, we found that duff removal increased the number of sprouting stems by 30-fold compared to control plots (paired t-test:  $t_{19} = 5.30$ ;  $p < 0.001$ ) and shifted vegetation communities towards more desirable herbaceous groundcover (PERMANOVA:  $F_{1,34} = 19.14$ ;  $p < 0.001$ ). Fire is recognized as an important source of disturbance in longleaf (*Pinus palustris*) and slash (*P. elliottii*) pine forests

of the southeastern United States, but the return of fire to degraded habitats may not be sufficient to fully restore historic conditions that are conducive to flatwoods salamander reproduction. Our results demonstrate that duff removal may be a critical component of wetland restoration to improve or accelerate the response of understory vegetation following canopy removal. © 2023, The Author(s), under exclusive licence to Society of Wetland Scientists.

4. Crespo, D., Faião, R., Freitas, V., Oliveira, V. H., Sousa, A. I., Coelho, J. P., & Dolbeth, M. (2023). Using seagrass as a nature-based solution: Short-term effects of *Zostera noltei* transplant in benthic communities of a European Atlantic coastal lagoon. *Marine Pollution Bulletin*, 197

**Abstracts:** Seagrass meadows provide several ecological functions that improve the overall ecological health of coastal systems and therefore, it is urgent to promote the restoration of such habitats. In Ria de Aveiro, a coastal lagoon in the Atlantic Coast of Portugal, a restoration initiative was responsible for transplanting the dwarf eelgrass *Zostera noltei* into a highly degraded area. This eelgrass was used as a nature-based solution (NbS) to mitigate some of the impacts of historical mercury contamination. Comparisons of key-species features (density and biomass), and some community-derived indicators (total density and biomass, species richness and Shannon-Wiener index) between the transplanted seagrass patch, their bare vicinities, and their counterpart habitats on the source area, provided signs of the effectiveness of the restoration action on the benthic communities' recovery. Indicators were higher within the restored meadow, and biomass derived indicators of the restored meadow were similar to the source meadow. © 2023 The Authors

5. Cui, Z., Fan, W., Chen, C., Mo, K., Chen, Q., Zhang, Q., & He, R. (2024). Ecosystem health evaluation of urban rivers based on multitrophic aquatic organisms. *Journal of Environmental Management*, 349

**Abstracts:** The ecosystem health evaluation method of urban rivers is significantly different from natural rivers, because of intensive human interferences and ecological restoration measures. Biotic integrity index (IBI) provides a method to quantify the response of aquatic organisms to environmental stress. Multi-trophic aquatic organisms may exhibit different

responses and sensitivities to stress factors, which affects the reliability of the IBIs. This study proposed a hypothesis that the biota with the higher trophic level (whose habitat was not completely destroyed) or that of the biota with the shorter life cycle would be more sensitive in urban rivers. To prove the above hypothesis, the ecosystem health status of urban rivers was evaluated by the IBIs across multitrophic groups, including benthic invertebrates, zooplankton, phytoplankton, periphyton algae and microorganisms. The reliability of the IBIs was assessed by estimating their relationship with water quality index (WQI). The spatial distribution differences of the IBIs were distinguished by spatial autocorrelation analysis. The results showed that the IBI based on benthic invertebrates cannot mask the effects of dredging. Compared with the IBIs from other trophic groups, the correlation coefficients between the IBIs based on zooplankton and microorganisms and WQI were higher. Moreover, the evaluation results of Z (Zooplankton)-IBI and M (Microorganism)-IBI were able to discriminate the least, medium and highly impaired site groups divided by WQI. For the spatial response mode, Z-IBI and M-IBI could identify the high-value river sections under ecosystem restoration projects, and Z-IBI could also identify the low-value river sections under intensive human interferences. Therefore, Z-IBI and M-IBI could be recommended as the priority application in urban rivers. The constructed ecosystem health evaluation framework for urban rivers would play a guiding role in reducing impairments and restoring water ecosystem quality. © 2023

6. Dittel, J. W., Sanchez, D., Ellsworth, L. M., Morozumi, C. N., & Mata-González, R. (2023). A case for adaptive management of rangelands' wicked problems. *Rangeland Ecology and Management*, 91, 105-111.

**Abstracts:** Sagebrush-steppe restoration has long been seen as a wicked problem—each case has multifaceted problems with no universal solutions—and thus managers have had to adopt adaptive management techniques to meet ever-changing landscape demands. In this study, we characterize the efficacy of an adaptive management plan in a severely degraded sagebrush-steppe winter range habitat for mule deer for 8 yr by monitoring the plant community. During this time, managers have actively managed juniper encroachment through felling and responded to a 2014 wildfire by applying herbicide and seeding for native and forage vegetation. We found that the adaptive management practices reduced annual invasive grasses by about half post fire and nearly doubled preferred herbaceous plants' cover and biomass.



However, these successes were only recorded in plots that received repeated treatments, whereas in plots that only received a single treatment post fire, invasive annual grasses returned to prefire cover. Despite these successes in recovering desired herbaceous composition, shrub regeneration was nearly nonexistent during the study period despite repeated attempts to seed.

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7. Fan, R., Liu, W., Jiang, S., Huang, Y., & Ji, W. (2023). Recovering from trampling: The role of dauciform roots to functional traits response of *Carex filispica* in alpine meadow. *Ecology and Evolution*, 13(11)

**Abstracts:** In the natural habitats of China, dauciform roots were only described in degraded alpine meadows. It was found that the presence of dauciform roots of *Carex filispica* was related to the advantage of multiple functional traits after trampling, reflecting short-term resistance. However, the long-term response of dauciform roots to trampling and the recovery of *C. filispica* with and without dauciform roots to trampling require further studies. In this study, different intensities of trampling (0, 50, 200 and 500 passages) were performed in an alpine meadow. One year later, individuals with and without dauciform roots were separated and their functional traits related to the economic spectrum of leaves and roots were measured as a reflection of recovery from trampling. The results showed that: (1) 1 year after trampling, the number of dauciform roots showed an increase with trampling intensity; (2) 1 year later, there was no significant difference in the response of economic spectrum traits among trampling intensities, or between plants with and without dauciform roots; (3) the number of dauciform roots was positively correlated with the leaf area of both individuals with and without dauciform roots, as well as with the biomass of those without dauciform roots; and (4) plants with more resource-conservative roots showed an advantage after trampling recovery: specifically, plants with dauciform roots showed such an advantage in the control group, which was lost with a leaning towards resource-acquisitive roots and an increased density of dauciform roots once trampled. In contrast, plants without dauciform roots showed a significant advantage of conservative roots only after trampling. In conclusion, the presence of dauciform roots is related to the plants' position on the root economic spectrum, thereby influencing the recovery of *C. filispica* from trampling. *Carex filispica* showed strong recovery from trampling after 1 year, which makes it an adequate choice for ecological restoration in alpine meadows. Dauciform roots showed a positive correlation with the aboveground growth of both plants

with and without them, however, it requires a lab-controlled study to confirm whether there is indeed a positive effect on the growth of neighbouring plants. © 2023 The Authors. Ecology and Evolution published by John Wiley & Sons Ltd.

8. Fanfarillo, E., Fiaschi, T., Castagnini, P., De Simone, L., & Angiolini, C. (2023). Vegetation and annex I habitats of a suburban river in southern tuscany (central italy): Remnants of plant diversity or need for restoration? *Hacquetia*, 22(2), 161-178.

**Abstracts:** Using vegetation as a bioindicator in urban and degraded areas is an effective way to assess the status of the environment. In this work, we present the results of a phytosociological investigation of a suburban river and of its surroundings in southern Tuscany (Bestina river and its tributary Bestinino in Asciano, Province of Siena). By means of 94 phytosociological relevés, we identified 34 plant communities belonging to the 17 classes. Six habitats included in the 92/43/EEC Directive, plus two habitats recently proposed for inclusion, were identified, as well as one habitat of regional interest. The study revealed that, despite the high levels of human disturbance, aquatic and herbaceous riparian vegetation is still well-preserved, though mostly represented by stress-tolerant communities. On the contrary, most of the vegetation types not being directly linked to the river dynamic are in poor conservation status. Despite this, some habitats of community interest were detected even in non-riverine sites. Our work provides the basic knowledge for future restoration of the Bestina river and of its surroundings, wished by the Tuscany Region. © 2023 Emanuele Fanfarillo et al., published by Sciendo.

9. Ferreira, Ó. (2023). The effectiveness of elevated boardwalks in restoring coastal dunes. *Journal of Environmental Management*, 345

**Abstracts:** Coastal dunes are important habitats that also play an important role in coastal protection. In areas of high tourist activity, they have often been degraded by trampling and intensive use, resulting in a loss of ecological, aesthetic and protective values. As a result, several management actions have been taken to minimise dune degradation and enhance their recovery. One of these measures is the installation of elevated boardwalks and dune crossovers to regulate human access to the beaches. This paper quantifies and analyses the impact of the installation of boardwalks and dune crossovers on dune recovery in a highly touristic area in

southern Portugal. This was done using aerial photographs taken before and 5–10 years after the implementation of the measures, and an effectiveness index was applied. The recovery observed was high to very high, ranging from 51% to 98% of the previously degraded dune. The areas with the oldest interventions showed an average recovery of 86% of the degraded area, while the most recently managed areas showed an average recovery of 69%. The high rate of recovery is mainly explained by the new habits developed by the population and tourists to access the beaches. Nevertheless, in some specific cases (i.e. where the use of the boardwalks requires a detour or where they end far from the beach) new degraded areas were observed, indicating the high relevance of the design of the boardwalks to the final recovery result. This work can serve as a basis for assessing the effectiveness of coastal management measures in any other coastal dune area with similar interventions. © 2023 The Author

10. Gan, J. L., Grainger, M. J., Shirley, M. D. F., & Pfeifer, M. (2023). How effective are perches in promoting bird-mediated seed dispersal for natural forest regeneration? A systematic review protocol. *Environmental Evidence*, 12(1)

**Abstracts:** Forest landscape restoration (FLR), often through tree planting, is one of the priorities in many global and national initiatives for carbon offsetting as part of climate change mitigation and biodiversity conservation. However, active efforts to meet FLR objectives entail substantial costs for the procurement of planting stocks and require an experienced workforce for planting and nurturing tree seedlings. Alternatively, restoration projects can be more cost-effective and potentially may have greater biodiversity gain through assisting and accelerating natural forest regeneration. The use of perches is one of the strategies under Assisted Natural Regeneration (ANR) and is used to attract avian seed dispersers to degraded habitats for increased tree seed supply and seedling establishment. This systematic review and potential meta-analysis aim to determine the effectiveness of artificial and natural perches in promoting natural forest regeneration. Specifically, we will evaluate their effectiveness in driving seed richness, seed density, seedling richness, and seedling density. The results will synthesize available evidence on the topic, identify knowledge gaps we need filling to upscale the strategy, and inform their use in concert with other ANR strategies. Methods: The search strategy was informed through a literature scan and discussions with stakeholders and experts. A total of eight databases, which include an organizational library and a web-based search engine, will be searched using the refined search string in English. The search string was formed using

keywords corresponding to the PICO structure of the research question, and its comprehensiveness was evaluated using 10 benchmark articles. The search results will be screened by the review team (composed of a primary and at least two secondary reviewers) using the set eligibility criteria at the title and abstract level, followed by the full-text screening. The screened studies will then undergo critical appraisal using the assessment criteria based on risk of bias and methods. Data from the accepted studies will be extracted to the standard data sheet for meta-analysis. Effect size (Hedges'  $g$ ) will be computed to determine whether perches are effective in increasing seed dispersal and seedling establishment in degraded sites. The effect of potential modifiers relating to the landscape will be explored via mixed models. © 2023, The Author(s).

11. Haq, S. M., Pieroni, A., Bussmann, R. W., Abd-ElGawad, A., & El-Ansary, H. (2023). Integrating traditional ecological knowledge into habitat restoration: Implications for meeting forest restoration challenges. *Journal of Ethnobiology and Ethnomedicine*, 19(1)

**Abstracts:** Traditional ecological knowledge (TEK) helps tribal communities adapt to socio-ecological changes, improving the long-term sustainability of their livelihood strategies and fostering social–ecological resilience. TEK provides thorough understanding of ecosystem dynamics, as well as how they relate to societal norms, practices, and resource use patterns. The integrity of TEK is often in jeopardy due to changes in belief systems, regional languages, traditional ways of subsistence, and disruption of traditional social–ecological systems. Landscape restoration has the ability to promote self-determination while safeguarding the livelihoods, beliefs, cultural, and biodiversity of indigenous peoples. However, there is a substantial knowledge gap on how TEK might aid ecosystem restoration, particularly in elephant corridors. **Methods:** The current study focused on gathering traditional ecological knowledge on the woody tree species from the Dering-Dibru Saikhowa Elephant Corridor using semi-structured interviews, group discussions, and direct observations. The acquired data were applied to heat map cluster analysis and ordination techniques using R software version 4.0.0. **Results:** Traditional usage information of 31 tree species utilized for food, fodder, timber, fuelwood, medicinal, and livelihood by local people was gathered. Most of the species utilized locally belonged to the families Combretaceae and Fabaceae. The species were classified into single, double, or multi-uses based on the extent of utilization. *Azadirachta indica*, *Phyllanthus*

emblica, and *Syzygium cumini* (six each) had the highest utilization, while *Mesua ferrea* had the lowest. *Chionanthus ramiflorus*, *Artocarpus heterophyllus*, and *Dillenia indica* were among the plants valuable to wildlife, providing both forage and habitat for a wide variety of birds and animals. *Artocarpus heterophyllus*, *Averrhoa carambola*, *Mangifera indica*, *P. emblica*, *Psidium guajava*, and *S. cumini* were among the plants important for the livelihoods of the local community. Our findings demonstrated that local people were knowledgeable about the plant species to use as pioneer species, such as *Bombax ceiba*, *Albizia lebbeck*, *D. indica*, *S. cumini*, *P. emblica*, *Lagerstroemia speciosa*, and *Alstonia scholaris*, for habitat restoration in a diverse habitat. We classified the habitat of the enlisted species into different categories, and two clusters (clusters 1 and 2) were identified based on the similarity of woody species in different habitats. We prioritized multiple tree species for eco-restoration using the information collected through TEK. We planted 95,582 saplings on 150 hectares in the Dering-Dibru Saikhowa Elephant Corridors' degraded habitat patches, which will serve as future reference site for landscape rehabilitation. Out of total saplings planted, 56% of the species were linked to native communities through ethnobotanical uses, as well as providing connectivity and habitat for elephant movement, 16% of all woody species are pioneer species to colonize a degraded habitat, 15% of all woody species are preferred food and foraging by wildlife, and 13% of the species as a source of livelihood for local people, incorporating social, economic, cultural, and biodiversity benefits into the restoration framework. Conclusion: The current study also provides insights how the TEK can assist with aspects of ecological restoration, from reference ecosystem reconstruction and adaptive management through species selection for restoration, monitoring, and evaluation of restoration effectiveness. © 2023, BioMed Central Ltd., part of Springer Nature.

12. Kirsten, T., Hoffman, M. T., Bell, W. D., & Visser, V. (2023). A regional, remote sensing-based approach to mapping land degradation in the little karoo, south africa. *Journal of Arid Environments*, 219

**Abstracts:** There is growing global consensus that assessments of land degradation be conducted at regional or smaller scales. Working at this scale allows for locally relevant environmental and land use conditions to be incorporated into the assessment methodology. In this paper, a recently developed regional approach to assessing land degradation in the Hardeveld bioregion of the Succulent Karoo is applied to the Little Karoo region of this biome.

The methodology uses fuzzy classification statistical techniques to combine field data with multiple Sentinel-2A and Landsat vegetation indices, as well as regionally modelled soil variables. The resultant habitat condition archetype map values show strong correlation with field observations of perennial plant and bare soil cover in 96 ground-truthed plots. The archetype map indicates that heavily degraded hotspots of high bare ground cover occur throughout the project region, although there is an overall lower average habitat condition in the western half of the Little Karoo. The mean habitat condition archetype value for the entire project area is 0.54 (standard deviation = 0.13), on a continuous scale where 0 and 1 represent the most degraded and pristine extremes, respectively. Random forest regression analysis of various environmental covariates of degradation indicates a strong relationship between habitat condition and topographic as well as rainfall variables, although the limited accuracy of modelled livestock data may obscure the negative impacts of overgrazing. The 30 m resolution habitat condition archetype map builds upon previous degradation research in the Little Karoo and has the potential to inform future conservation, restoration, and rangeland management decisions. The methodology was successfully transferred to a new region and provides an opportunity to improve reporting on the extent of land degradation across South Africa. © 2023 Elsevier Ltd

13. Lin, J., He, S., Liu, X., Huang, Z., Li, M., Chen, B., & Hu, W. (2024). Identifying conservation and restoration priorities for degraded coastal wetland vegetations: Integrating species distribution model and GeoDetector. *Science of the Total Environment*, 906

**Abstracts:** The ongoing degradation of seagrass and seaweed is of global concern. Comprehending the spatial distribution of these wetland vegetation types and the threats they face becomes critical for effective conservation and restoration efforts. In this study, we combined a species distribution model and geographical detector to propose a novel framework for mapping the distribution and disturbance of degraded coastal wetland vegetation in sparsely recorded areas and identifying conservation and restoration priorities. Guangxi is a province in China known for its extensive coastal wetland vegetation. In our study of Guangxi, habitats suitable for two degraded vegetation types, i.e., seagrass and seaweed, were mapped using the maximum entropy model; 669.44 km<sup>2</sup> of seagrass habitat and 929.69 km<sup>2</sup> of seaweed habitat were identified. The geographical detector model was used to analyze anthropogenic

disturbance caused by four local disturbance factors: shoreline development, fisheries, waterways, and ports and anchorages. Shoreline development was identified as the disturbance factor with the strongest impact on potential habitats of both vegetation types. According to these findings, 48.40 %–64.23 % of the vegetation habitats suffered from high anthropogenic disturbance. Preexisting nature reserves had not effectively protected wetland vegetation from human disturbance. Based on the spatial pattern of vegetation habitat and comprehensive anthropogenic disturbance, conservation and restoration priorities for seagrasses and seaweeds covering an area of 302.26 km<sup>2</sup> were further mapped. Our results thus help improve wetland vegetation conservation by providing basic information, and they provide a tool to support site planning for seagrass and seaweed conservation and restoration. © 2023 Elsevier B.V.

14. Morrison, R. R., Simonson, K., McManamay, R. A., & Carver, D. (2023). Degradation of floodplain integrity within the contiguous united states. *Communications Earth and Environment*, 4(1)

**Abstracts:** Despite the numerous hydrological, geological, and ecological benefits produced by floodplain landscapes, floodplains continue to be degraded by human activities at a much higher rate than other landscape types. This large-scale landscape modification has been widely recognized, yet a comprehensive, national dataset quantifying the degree to which human activities are responsible for this degradation has not previously been evaluated. In this research, we analyze floodplain integrity for the contiguous United States by spatially quantifying the impact of anthropogenic stressors on almost 80,000 floodplain units. We demonstrate the prevalence of human modifications through widely available geospatial datasets, which we use to quantify indicators of floodplain integrity for five essential floodplain functions of flood attenuation, groundwater storage, habitat provision, sediment regulation, and organics and solute regulation. Our results show that floodplain degradation is spatially heterogeneous and that the integrity of nearly 70% of floodplains in the United States is poor. We highlight that quantifying the integrity of spatially explicit floodplain elements can allow for restoration efforts to be targeted to the areas in most desperate need of preservation. © 2023, The Author(s).

15. Randé, H., Michalet, R., Nemer, D., & Delerue, F. (2023). Relative contribution of canopy and soil effects between plants with different metal tolerance along a metal pollution gradient. *Science of the Total Environment*, 904

**Abstracts:** Multiple effects, operating either on the long-term (soil-engineering effects) or on the short-term during plant life (microclimate modification or resources pre-emption), can act simultaneously and determine the outcome of plant-plant interactions. These diverse effects have not been disentangled along a gradient of metal/metalloid pollution, although this is crucial for understanding the dominant species turnover along the gradient, and thus the driving processes of facilitation recurrently found in metalliferous ecosystems, which could help improving ecological restoration of these degraded ecosystems. Here, we experimentally assessed different short-term effects of two dominant forbs of highly polluted habitats (*Hutchinsia alpina* and *Arenaria multicaulis*, tolerant to metal stress) and two grasses of less polluted habitats (*Agrostis capillaris* and *Festuca rubra*, less tolerant to metal stress) on target plant species (the same as the dominant species mentioned above) transplanted along a large metal pollution gradient. Additionally, in highly polluted environments, we differentiated short- from long-term effects of the two metallicolous forbs, which had different abilities to concentrate metals in their leaves. In line with other studies along metal gradients, variation of short-term interactions appeared to follow the Stress Gradient Hypothesis for plants less adapted to metal pollution ( $p = 0.030$ ), with positive interactions dominating in most severe areas. Regarding long-term effects, the species with highest leaf metal-accumulation showed no negative effect contrary to the Elemental allelopathy Hypothesis. Long-term effects of the species with lower leaf-metal accumulation could not be determined because of the occurrence of an unexpected difference in micro-habitat conditions (soil depth and humidity) for this species along the metal pollution gradient. Increasing short-term facilitation along metal pollution gradients, which confirmed previous studies, is promising for improving conditions and restoring the most polluted environments. However, long-term results stressed the difficulty to quantify these effects given that these areas are highly fragmented and heterogeneous. © 2023 Elsevier B.V.

16. Riera, R., Torquato, F., Range, P., Ben-Hamadou, R., Møller, P. R., & Tuset, V. M. (2023). Are offshore platforms a good candidate to restore functional diversity of reef fish communities in the arabian gulf? *Regional Studies in Marine Science*, 66



**Abstracts:** Human-made structures are ubiquitous in the marine realm. Complex structures such as oil and gas platforms may constitute a suitable habitat for species in areas where natural reefs have been highly degraded by coastal development. We here explore the suitability of fish assemblages associated to offshore platforms as surrogates for depleted fish stocks from coastal areas. Taxonomic and functional diversity have been used as approaches to test this hypothesis. Beta diversity components (nestedness and turnover) have also been assessed to unveil the magnitude of the differences between fish-associated communities from offshore platforms and natural reefs. The results showed a sharp difference between natural and artificial reef assemblages, suggesting that these artificial structures may not be suitable candidates serving as surrogates of fish assemblages. Natural reefs were characterized by a depletion of species and abundances, typical of overfished sites, together with other factors such as depth and substrate complexity. Reefs at medium depth in the eastern part of oil platforms, i.e. Kharaza, Maydam Mahzam and Fast east-Halul, showed the highest species richness (19–25 taxa) and functional richness. Thus, our results showed that offshore platforms harbor different fish species composition and community structures than natural reefs. Hence, the conservation of natural reefs under pressure, and artificial systems that act as marine protected areas are of utmost importance to preserve the fish biodiversity in the region. From our perspective, an integrative management of both natural and artificial structures is urgently needed, considering the extensive number of installations that will be decommissioned in the study region. The present results have ecological implications of utmost importance that need to be considered in coastal planning of the Arabian Gulf where a substantial portion of natural reefs have been drastically transformed. © 2023 The Author(s)

17. Sharafatmandrad, M., & Khosravi Mashizi, A. (2023). Evaluation of restoration success in arid rangelands of Iran based on the variation of ecosystem services. *Journal of Arid Land*, 15(11), 1290-1314.

**Abstracts:** The plantation of non-native species is one of the most expensive ecological restoration measures in arid and semi-arid areas, while its impacts on local communities are largely ignored. This study assessed the rate of change and the dynamic degree of the economic values of ecosystem services related to local conservation (water yield, stocking rate and aesthetic value) and preserving the future (carbon sequestration, soil protection, soil stability and habitat provision) to determine the restoration success of the plantation of non-native

species *Haloxylon ammodendron* (C.A.Mey.) Bunge ex Fenzl (15- and 30-year-old) in parts of arid rangelands of Bardsir region, Kerman Province, Iran. We investigated the impacts of the two plantations on the seven ecosystem services and ecosystem structures (horizontal and vertical structures, vegetation composition and species diversity) based on field sampling and measurements at four sampling sites (i.e., control, degraded, and 15- and 30-year-old plantation sites) in spring and summer of 2022. The restoration success of the plantation of non-native species was then examined by assessing the rate of change and the dynamic degree of the total economic value of all ecosystem services as well as the rate of change and the dynamic degree of the economic values of ecosystem services for the two groups (local conservation and preserving the future). Although the plantation of non-native species *H. ammodendron* enormously improved the vertical and horizontal structures of ecosystems, it failed to increase species diversity and richness fully. Further, despite the plantation of non-native species *H. ammodendron* had significantly increased the economic values of all ecosystem services, it was only quite successful in restoring carbon sequestration. Path analysis showed that plantation age had a significant impact on restoration success directly and indirectly (through changing ecosystem structures and services). The dynamic degree of the economic values of ecosystem services related to local conservation and preserving the future at the 15- and 30-year-old plantation sites indicated that the two plantations successfully restored the ecosystem services related to preserving the future. The presented method can help managers select the best restoration practices and predict their ecological-social success, especially for the plantation of high-risk non-native species in arid and semi-arid areas. © 2023, Xinjiang Institute of Ecology and Geography, Chinese Academy of Sciences, Science Press and Springer-Verlag GmbH Germany, part of Springer Nature.

18. Smith, T. C., Bishop, T. B. B., Duniway, M. C., Villarreal, M. L., Knight, A. C., Munson, S. M., Waller, E. K., Jensen, R., & Gill, R. A. (2023). Biophysical factors control invasive annual grass hot spots in the Mojave desert. *Biological Invasions*, 25(12), 3839-3858.

**Abstracts:** Invasive annual grasses can promote ecosystem state changes and habitat loss in the American Southwest. Non-native annual grasses such as *Bromus* spp. and *Schismus* spp. have invaded the Mojave Desert and degraded habitat through increased fire occurrence, severity, and shifting plant community composition. Thus, it is important to identify and

characterize the areas where persistent invasion has occurred, identifying where subsequent habitat degradation has increased. Previous plot and landscape-scale analyses have revealed anthropogenic and biophysical correlates with the establishment and dominance of invasive annual grasses in the Mojave Desert. However, these studies have been limited in spatial and temporal scales. Here we use Landsat imagery validated using an extensive network of plot data to map persistent and productive populations of invasive annual grass, called hot spots, across the entire Mojave Desert ecoregion over 12 years (2009–2020). We also identify important variables for predicting hot spot distribution using the Random Forest algorithm and identifying the most invaded subregions. We identified hot spots in over 5% of the Mojave Desert mostly on the western and eastern edges of the ecoregion, and invasive grasses were detected in over 90% of the Mojave Desert at least once in that time. Across the entire Mojave Desert, our results indicate that soil texture, aspect, winter precipitation, and elevation are the highest-ranking predictive variables of invasive grass hot spots, while anthropogenic variables contributed the least to the accuracy of the predictive model. The total area covered by hot spots varied significantly among subregions of the Mojave Desert. We found that anthropogenic variables became more important in explaining invasive annual establishment and persistence as spatial scale was reduced to the subregional level. Our findings have important implications for informing where land management actions can prioritize reducing invasive annual persistence and promoting restoration efforts. © 2023, The Author(s).

19. Yusof, N. N. M., Hatta, S. K. M., Kamarudin, S. H., Jamil, N. M., Supardan, S. N., & Suratman, M. N. (2024). Forest landscape restoration for environmental management. *Land and environmental management through forestry* (pp. 161-199)

**Abstracts:** Forest resources around the world have been under immense pressure mainly due to anthropogenic activities. Land use changes have taken place caused by an increase in commercial agricultural as well as an intensified development for human settlements and infrastructure advancement, leading to the decline in forest cover. In addition, a substantial amount of forest loss is also contributed by natural phenomena such as drought and tree diseases which are different in magnitude between countries. The dwindling forest area has negatively affected our ecosystem by decreasing the biodiversity as a direct result of habitat loss and depletion in food source. This could bring about a cascade of environmental issues including reduction in plant production, increase in soil erosion, water and air pollution, as well

as reducing the efficiency of carbon sequestration. In order to moderate the negative impacts, an implementation of forest landscape restoration (FLR) could improve the health and productivity of forests. FLR involves various stakeholders coming together and reinstating the forest landscape at any scale using appropriate approaches. Through careful planning of FLR operations, forest restoration can be executed which will be beneficial not only to the forests, but also to the whole ecosystem by enhancing food security, air and water quality as well as reducing the adverse impact of climate change to our planet. This chapter aims at introducing the roles of FLR in restoring ecological functionality of degraded forest landscapes. The various tools used in conducting FLR to support human well-being and biodiversity will be highlighted. Finally, the implementation of FLR in meeting the present and future needs of mankind will also be discussed. © 2023 Scrivener Publishing LLC. All rights reserved.

20. Zhang, C., Xiao, X., Wang, X., Qin, Y., Doughty, R., Yang, X., Meng, C., Yao, Y., & Dong, J. (2024). Mapping wetlands in northeast china by using knowledge-based algorithms and microwave (PALSAR-2, sentinel-1), optical (sentinel-2, landsat), and thermal (MODIS) images. *Journal of Environmental Management*, 349

**Abstracts:** Wetlands are rich in biodiversity, provide habitats for many wildlife species, and play a vital role in the transmission of bird-borne infectious diseases (e.g., highly pathogenic avian influenza). However, wetlands worldwide have been degraded or even disappeared due to natural and anthropogenic activities over the past two centuries. At present, major data products of wetlands have large uncertainties, low to moderate accuracies, and lack regular updates. Therefore, accurate and updated wetlands maps are needed for the sustainable management and conservation of wetlands. Here, we consider the remote sensing capability and define wetland types in terms of plant growth form (tree, shrub, grass), life cycle (perennial, annual), leaf seasonality (evergreen, deciduous), and canopy type (open, closed). We identify unique and stable features of individual wetland types and develop knowledge-based algorithms to map them in Northeast China at 10 m spatial resolution by using microwave (PALSAR-2, Sentinel-1), optical (Landsat (ETM+/OLI), Sentinel-2), and thermal (MODIS land surface temperature, LST) imagery in 2020. The resultant wetland map has a high overall accuracy of >95%. There were a total 154,254 km<sup>2</sup> of wetlands in Northeast China in 2020, which included 27,219 km<sup>2</sup> of seasonal open-canopy marsh, 69,158 km<sup>2</sup> of yearlong closed-canopy marsh, and 57,878 km<sup>2</sup> of deciduous forest swamp. Our results demonstrate the

potential of knowledge-based algorithms and integrated multi-source image data for wetlands mapping and monitoring, which could provide improved data for the planning of wetland conservation and restoration. © 2023 Elsevier Ltd

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