POLICY BRIEF

Nature-based Solutions for Climate Resilient Infrastructure Planning in the Philppines

2025

SIPA Sustainable Infrastructure Programme in Asia
Supported by: Federal Ministry for Economic Affairs and Climate Action on the basis of a decision by the German Bundestag
IKI INTERNATIONAL CLIMATE INITIATIVE

KEY FINDINGS

- Ecosystems most impacted by road infrastructure and settlement development within 15-25km support climate resilience for nearly 54 million people and 66% of the road network on just 19% of Philippines' lands.
- Evaluating all intact ecosystems nationwide that could support NbS benefits, conserving priority areas on just 16% of Philippines' land area supports climate resilience for 43 million people and 42% of the road network.
- Restoring degraded forests to support multiple NbS to enhance climate resilience found on just 13% of the country would benefit about 51 million people and close to 52% of the road network.
- Most of these priority areas are outside the protected area network, necessitating new regulatory approaches or land use management schemes for successful conservation or restoration efforts.
- There are, however, immediate "win-win" opportunities for NbS investments under conservation or restoration inside protected areas and Key Biodiversity Areas that would simultaneously support climate resilience for people and infrastructure and biodiversity outcomes.
- These analyses would be particularly useful for planning and prioritization processes of the NEDA's Infrastructure Flagship Program, the next update of the Philippine Development Plan (PDP), and the ongoing update of the Philippine Biodiversity and Conservation Plan (PBSAP).
- Achieving this requires investments in training and capacity building programs at all levels across these agencies and key departments on how to assess and integrate NbS in infrastructure planning. WWF and the University of Philippines Los Banos (UPLBFI) have developed such training materials for this purpose under the SIPA project.
- Maps and associated data should be integrated into existing key agencies and departmental web platforms and centralized national data and mapping platforms like the NAMRIA Geo Portal to ensure maximum utility for planners across departments and agencies.

SUMMARY

This brief summarizes the results of modeling analysis to determine potential priority areas for Nature-based Solutions (NbS) for climate resilience for people and infrastructure in the Philippines. Four key benefits provided by nature were assessed: sediment retention (erosion control), flood risk reduction, water recharge (for supply), and coastal protection (of people and infrastructure). It closes with recommendations for how to integrate these analyses in infrastructure development, climate adaptation, and conservation planning moving forward. The analysis provides useful information for planners at the National Economic and Development Authority (NEDA), the Department of Public Works and Highways (DPWH), the Department of Environment and Natural Resources (DENR), local government units, and other relevant government agencies at the national and subnational levels in guiding infrastructure planning and siting decisions.

CONTEXT

Philippines is among the most vulnerable countries to future climate extremes.

In the face of intensifying climate change and biodiversity loss, Philippines must balance trade-offs between increasing economic development, preserving large biodiversity hotspots, and addressing infrastructure service gaps that still affect millions. In the last two decades, the Philippines has lost 190 kha of primary forest cover, with the largest deforestation occurring in 2023 of about 27.3 kha primary forests. Overall, the country has lost about 1.47 Mha of tree cover representing about 8% decrease since the turn of the century.[1]

Forests are essential for maintaining ecological balance, acting as carbon sinks, habitats for diverse species, and providers of crucial environmental services like water regulation, flood risk reduction, sediment retention, clean water supply, coastal protection, and carbon storage. However, transportation infrastructure such as roads significantly impacts surrounding ecosystems and biodiversity. Planning and construction of roads opens access to intact forest ecosystems increasing their susceptibility to land use conversion. Between 1934 to 1988 about 9.8 Mha of forest was lost of which 78% (2.1 Mha) deforestation occurring within 1.5km of road development.[2] A study analyzing the impacts of roads on the Upper Marikina River Basin in Rizal showed that between 2005-2020 the forest cover in this region decreased by over 15% when the road networks in the region increased by fivefold.[3]

Even though the National Greening Program (NGP) has had positive impacts in reforesting large swaths of degraded lands, the rate of reforestation has reduced since 2019.[4] Agricultural expansion, infrastructure development, increased tourism, and forestry are some of the key drivers of the deforestation.[5] Climate related disasters are intensifying the effects of environmental degradation due to human activities. The Philippines which is considered as one of the most disaster-prone countries faces increasing threats from future climate hazards such as floods, typhoons, droughts, landslides, and mud slides.[6] Over 60% of the land area is vulnerable to one or more of these climate hazards exposing over 74% of the population to climate extremes.[7] For example, Philippines has been incurring economic losses of between 2 to 3% annually due to the impacts of floods, typhoons, and tropical storms.[8] If no action is taken, then these impacts could cost about 18% of the GDP by 2070 under a high emission scenario.[9]

Integrating sustainability into these projects provides a crucial opportunity to avoid and mitigate significant climate risks.

Planners and decision makers at NEDA, DENR, DPWH, and other key national level planning agencies are facing these challenges as they aim to achieve Philippines' global climate commitments in alignment with national economic goals. The national budget reflects this, with increasing allocations for climate and environment in recent years while infrastructure continues to remain significant.[10, 11, 12, 13] This spending presents a significant opportunity to avoid mistakes of the past that failed to properly account for impacts on, and benefits of, nature in infrastructure development. There is ever greater awareness across sectors about the "win-wins" or even triple wins that nature-based solutions can provide in addressing climate change (both emissions and impacts from new hazards), biodiversity loss, and simultaneously create economic opportunities.

Under the Sustainable Infrastructure Programme in Asia (SIPA), WWF is working to mainstream NbS into infrastructure planning in the Philippines, in alignment with national strategies to meet global climate and biodiversity commitments.

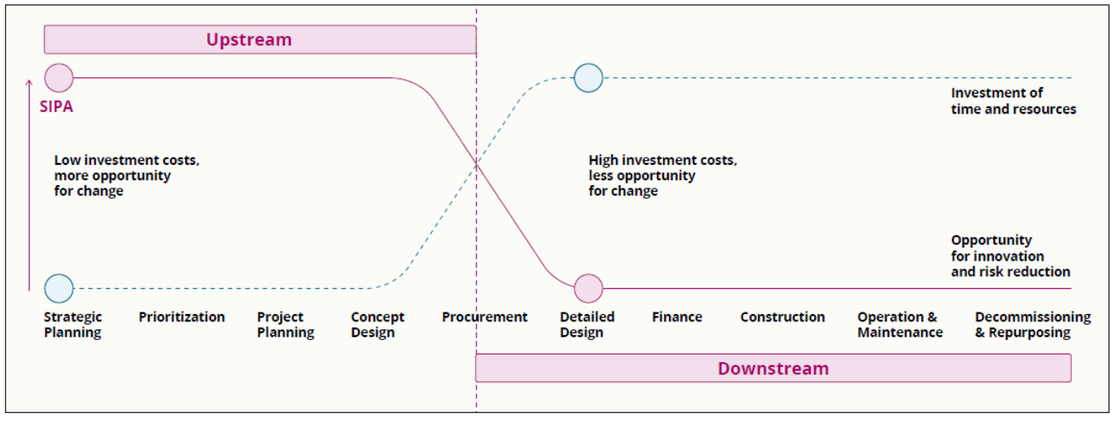


Figure 1. The benefits of considering nature-based solutions opportunities in the earliest stages of infrastructure planning.

METHODOLOGY

The results focus on areas that provide at least one key service, offering maximum benefits to communities or infrastructure (roads) under three scenarios: two for conservation and one for restoration. Only areas in the top 10% for both current and future climate conditions were selected as "climate-robust" priorities for conservation and restoration. Constructing conservation scenarios requires a counterfactual of what could occur without conservation, represented through land-use conversion mapping. The three scenarios are:

1. **Unconstrained Conservation**: we modeled the loss of ecosystem services by converting all relatively intact forest areas nationwide into agriculture. By evaluating this loss from deforestation, we estimate the marginal value of the service on each pixel, which helps to identify the most critical areas for conservation that provide climate resilience benefits for people and roads downstream and along coastlines (e.g., sediment retention, water filtration, coastal protection).
2. **Infrastructure Impact Conservation**: this scenario focuses on forests within 25 km of roads near urban areas and 15 km in rural areas. It estimates the degradation of biophysical service value due to roads within the buffer, highlighting priority areas around current infrastructure that are most important to maintain to not lose resilience benefits for roads and people.
3. **Restoration**: all agricultural and barren lands are reclassified as "secondary forest", which is beneficial but not as high-quality as primary forest. We then run biophysical models to compare this restored land cover to the current one and assess the changes in ecosystem service supply. This value, combined with the number of people or kilometers of roads benefiting, provides the full added value of the service for restoration to show which areas are most important to restore to enhance climate resilience.

The analysis evaluated four ecosystem services nationally in Indonesia:

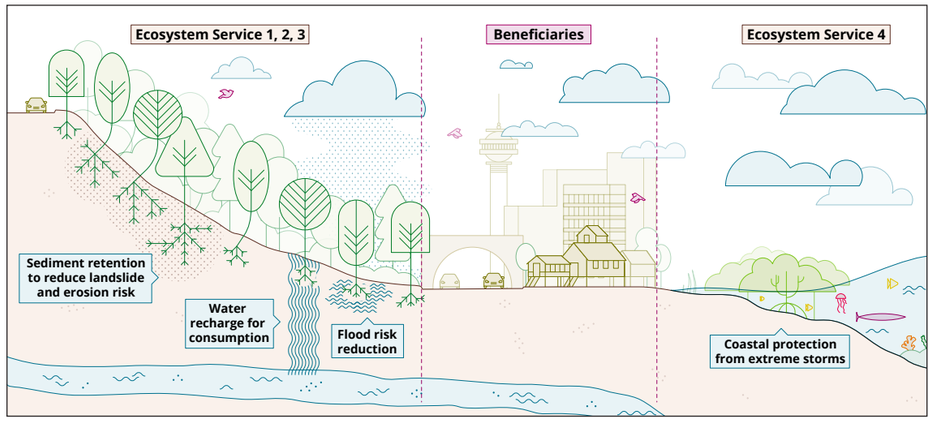


Figure 2. The four ecosystem services that act as nature-based solutions for climate resilience.

KEY RESULTS FROM THE ANALYSIS

The analysis pinpoints the locations and magnitude of benefits—measured in total kilometers of roads and millions of people—where conservation and restoration efforts (NbS) should be prioritized. This section highlights key results and findings for each of three scenarios:

Scenario 1: Unconstrained conservation areas

Our findings reveal that ecosystems covering 16% of total land area of the country (4.6 million hectares) play a critical role in supporting climate resilience by providing more than one service to people and infrastructure. Predominantly located in the regions II, III, VI, X, and Cordillera Administrative Region (CAR), only 25% of this total area lies within the Protected Area (PA) network (75% outside it), with 14% intersecting with Key Biodiversity Areas (KBAs). Implementing conservation measures in these identified areas would afford greater protection to residents and both existing and future infrastructure assets from climate extremes like worsening flooding, drought, and coastal storms. In total, nearly 41% of the total population, or 43 million people and 42% of roads (15,800 km) downstream and in low-lying coastal areas could potentially benefit from these areas.

Scenario 2: Infrastructure impact conservation areas

In this scenario, 19% of the country's total land area (5.6 million hectares) within the 15-25km buffer surrounding roads and settlements plays a critical role in supporting climate resilience. Given the proximity to roads, not surprisingly only 17% of this area lies within the Protected Area (PA) network, with 9% intersecting with Key Biodiversity Areas (KBAs). The climate resilience of approximately 53 million people, more than half the population, and roughly 56% of the nation's roads depends on conserving the priority areas most impacted by infrastructure and development (within the 15-25 km buffer). Simply stated the impacts to people and roads from worsening climate hazards like floods, droughts, erosion, and coastal storms will be worse if these areas are deforested or degraded.

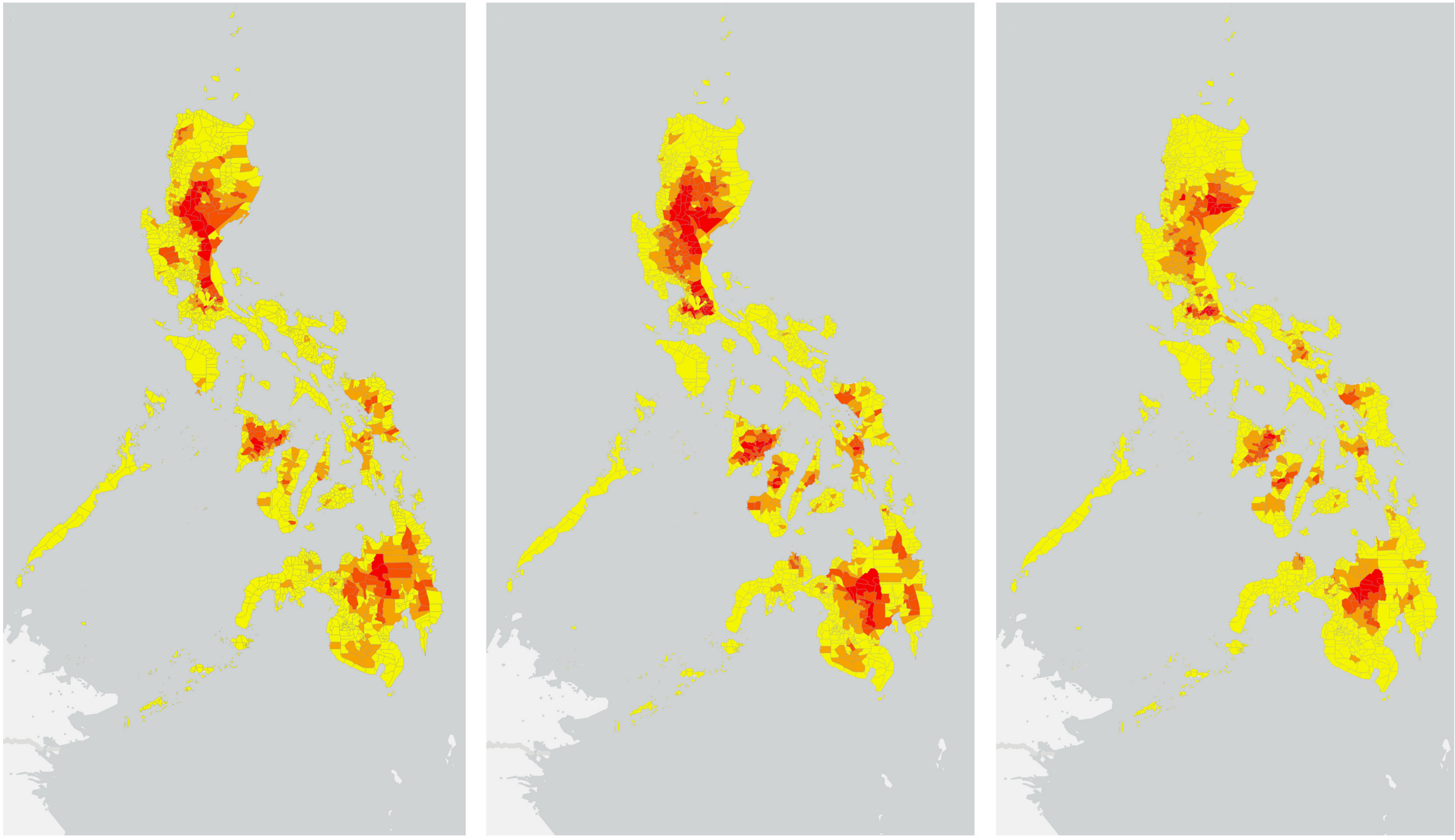
Scenario 3: Restoration Areas

Our results highlight significant opportunities to enhance adaptive capacity for people and improve road resilience through restoration NbS. Key regions such as I, II, III, IV-A, and X, show potential for large-scale restoration strategies to be integrated into infrastructure planning and design to improve resilience. Restoring degraded forests on just 13% of the country's land area would benefit millions of people and thousands of kilometers of roads. Only 7% of these areas are inside Protected Areas (PAs) and 3% intersect with Key Biodiversity Areas (KBAs). Restoration in these areas would enhance resilience for 51 million people and protect 52% of the national road network. The restoration scenario demonstrates the effectiveness of PAs and KBAs, with most priority areas found outside of them.

Unconstrained Conservation:
All potential areas supporting NbS

Infrastructure Impact Conservation:
Avoiding the loss of NbS in areas impacted by infrastructure

Restoration:
Potential NbS Areas



0 125 250 500 Kilometers

Distribution of conservation and restoration hotspots by each municipality

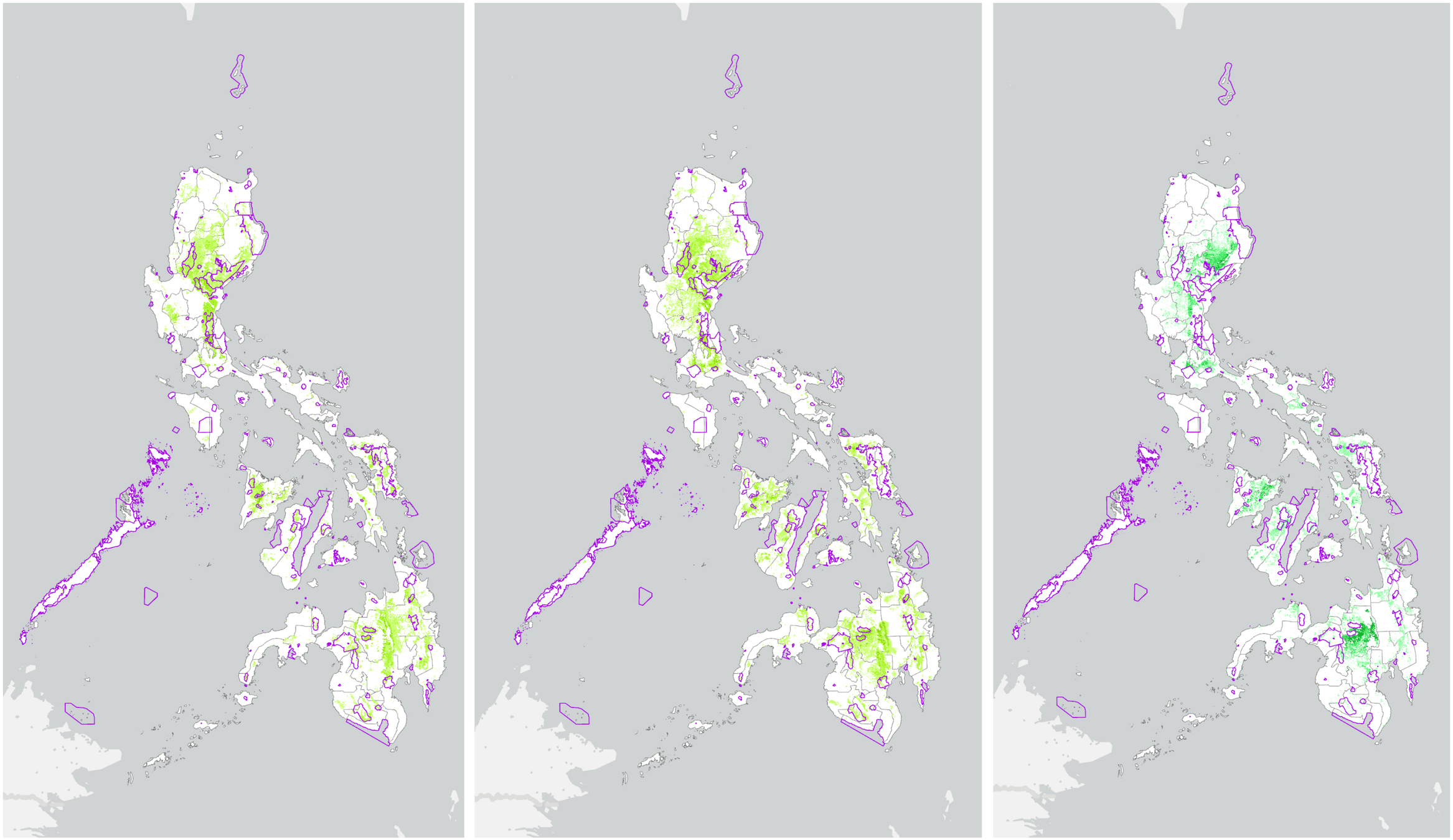
- Low importance
- Medium importance
- High importance
- Very high importance

The intensity of the color represents the total ecosystem service contribution, with darker colors indicating districts that have a higher number of services spread over a larger area.

Unconstrained Conservation:
All potential areas supporting NbS

Infrastructure Impact Conservation:
Avoiding the loss of NbS in areas impacted by infrastructure

Restoration:
Potential NbS Areas



0 125 250 500
Kilometers

- *Areas providing single service*
- *Areas providing two services*
- *Areas providing three services*
- *Areas providing four services*

The intensity of the color represents the total number (1, 2, 3 or 4) of ecosystem services an area provides to the people and infrastructure downstream.

RECOMMENDATIONS

These analyses can strengthen climate resilience in the Philippines by integrating nature-based solutions (NbS) into conservation, infrastructure, and climate adaptation policies and projects at both national and subnational levels. They are especially valuable during the early stages of spatial and strategic infrastructure planning, where there is the greatest opportunity to address climate and biodiversity risks proactively. With their broad national scope, these results can also complement existing mapping tools used in planning processes such as Strategic Environmental Assessments (SEAs) and Environmental Impact Assessments (EIAs). To maximize their impact, we recommend the following actions to embed NbS in infrastructure planning across the Philippines:

1. **Integrate these maps and analysis into existing risk assessment web portals and associated planning tools within and across agencies, including GeoRisk and DENR's Climate Risk Diagnostic Tools.** As the primary centralized web portal for assessing climate risks nationwide, GeoRisk and its associated tools, including the forthcoming Plan Smart climate adaptation planning tool for cities, and DENR's new diagnostic tool, should be updated to include layers on priority areas for conservation and restoration for NbS for adaptation (e.g. the data layers and final maps for these analyses). Internal mapping databases and tools within agencies like DPWH to evaluate routes, connectivity, land use, and other critical inputs as part of transportation master planning could also be updated to integrate the full data and results of these analyses.

2. **Enhance inter-agency collaboration to support implementation of NbS in identified priority areas to meet climate and biodiversity plans and goals.** NEDA, DPWH, the Climate Change Commission (CCC), and DENR should collaborate to capitalize on existing mechanisms, such as the National Asset Management Plan (NAMP), Philippine Biodiversity Strategy and Action Plan (PBSAP), National Adaptation Plan (NAP), and forthcoming updated National Climate Change Action Plan (NCCAP), targeting priority areas. Such a joint effort would align with NAMP's overarching goal of enhancing the cost-effectiveness of public expenditures for national assets and provide co-benefits for biodiversity. For instance, conserving or restoring areas in Bukidnon province could provide crucial flood and landslide protection for downstream roads. Additionally, leveraging the People's Survival Fund (PSF) could provide financing for local adaptation projects focused on conserving intact ecosystems and restoring degraded areas which would not only reduce maintenance costs but also bolster resilience.

3. **Leverage the Build Better More (BBM) program budget to strategically invest in priority nature-based solutions identified in this analysis as "natural infrastructure".**The BBM program, allocating Php 148B for the development of over 700 km of new roads and an additional Php 4.7B for environmental conservation, provides a unique opportunity to fund significant conservation and restoration efforts that would directly enhance climate resilience for not just infrastructure but communities downstream, while simultaneously creating significant co-benefits for ecosystems and wildlife.

4. **Consider expansion of the National Integrated Protected Areas System (NIPAS) or other mechanisms to reduce land use change in the priority areas identified in the analysis outside PAs, particularly "conservation" areas delivering maximum benefits.** Given that large areas that deliver multiple benefits are currently outside the PA system, there are significant opportunities for investment that would enhance climate resilience for downstream infrastructure and communities through new designations and management schemes to limit land use change. In collaboration with NEDA, DPWH, and the National Commission on Indigenous Peoples (NCIP) where conservation overlap with ancestral domains, the DENR should ensure that infrastructure projects steer clear of these designated areas during the planning and siting phases. These crucial measures should be integrated into the Philippine Biodiversity Strategy and Action Plan (PBSAP) as well as in the next update of the Philippine Development Plan (PDP).

5. **Enhance NEDA's Infrastructure Flagship Project (IFP) Selection Process to incorporate NbS as a key project selection criterion.** For the team of technical experts engaged in the selection and prioritization of NEDA's Infrastructure Flagship Projects (IFPs), there are multiple opportunities for integration:

    - Incorporate ecosystem and biodiversity criteria in siting decisions as a requirement in the 'Revised Guidelines for the Formulation, Prioritization and Monitoring of the Government's Infrastructure Flagship Projects (IFPs).' During project submissions for the IFP process, project teams should explicitly demonstrate how NbS options are spatially integrated in proposed siting and design decisions to maximize the avoidance of priority conservation areas and restoration opportunities.

    - The IFP's INFRACOM team responsible for technical evaluation could utilize the maps in their technical assessment of infrastructure proposals before presenting them to the Investment Coordination Committee (ICC) for approval. Through this process, for example, collaboration with DENR's Multi-Stakeholder Monitoring Team (MMT) could help integrate priority areas for Nature-based Solutions (NbS), as identified in this analysis, into the requirements for Environmental Compliance Certificates (ECCs) issuance.

6. **Revise the Public Investment Program's (PIP) Online System (PIPOL) to require project developers to submit:**

    - Articulation of considerations and rationale guiding routing choices, including surrounding conservation areas and potential restoration opportunities;

    - Specification of the land area (in sq. km) with substantial ecosystem service

provision that may be impacted by the project, accompanied by proposed conservation and/or restoration strategies aimed at preventing or mitigating harm.

- Provide detailed plans illustrating collaborative efforts among key agencies within the project team for developing protection/restoration measures over the entire project lifespan.

7. **Include NbS as a procurement requirement for Public-Private-Partnerships (PPPs) for major infrastructure projects.** As the Public-Private-Partnership Center (PPC) develops additional tools to mainstream sustainability and climate resilience to meet safeguards with technical support from the Asian Development Bank (ADB), these mapping layers and identified priority areas for conservation and restoration could provide valuable additional inputs at multiple scales. They will only be useful, however, if considerations of nature-based solutions at scale that support climate resilience are a mandated key project selection criteria.

8. **Invest in training and capacity building programs at the national and subnational levels to train planners and key technical staff across agencies and departments in NbS.** WWF and the University of the Philippines Los Banos Foundation (UPLBFI) have worked with partners in the Caraga Region and Agusan Del Norte Province, including Butuan City and other LGUs to create similar analyses and training materials in at the subnational level. These could be used to train experts around the country to evaluate and integrate relevant NbS in planning analyses and decision making moving forward to maximize climate resilience, sustainability, and biodiversity co-benefits.

REFERENCES

1. Vizzuality, Philippines Deforestation Rates & Statistics | GFW, accessed January 9, 2025, https://www.globalforestwatch.org/dashboards/country/PHL?category=undefined.

2. “Rates and Patterns of Deforestation in the Philippines: Application of Geographic Information System Analysis,” Forest Ecology and Management 57 (1993): 1–16, accessed January 9, 2025, https://www.sciencedirect.com/science/article/pii/037811279390158J.

3. Tricia Joy Castañeda and Diomedes Racelis, “Impact Assessment of Road Development on Forest Cover in the Upper Marikina Watershed, Philippines,” Ecosystems and Development Journal 13, no. 1 (October 16, 2023): 33–46.

4. Philippines Forest Statistics (PFS) 2023. Google Docs. Accessed January 9, 2025. https://drive.google.com/file/u/0/d/1uYMd6FJosiT-12ltzZM8veYujjK_u3t3/preview?pli=1&usp=embed_facebook.

5. Antonio P. Carandang, Leonida A. Bugayong, Priscila C. Dolom, Leni N. Garcia, Ma. Magdalena B. Villanueva, Nena O. Espiritu, and the Forestry Development Center, University of the Philippines Los Baños - College of Forestry and Natural Resources, “Analysis of Key Drivers of Deforestation and Forest Degradation in the Philippines” (Philippines: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, 2013), https://www.giz.de/en/downloads/giz2013-en-key-drivers-deforestation-forest-degradation-philippines.pdf.

6. Asian Development Bank, Climate Risk Country Profile: Philippines, August 10, 2021, https://www.adb.org/publications/climate-risk-country-profile-philippines.

7. UNDRR, Disaster Risk Reduction in the Philippines, December 23, 2019, https://www.unisdr.org/files/68265_682308philippinesdrmstatusreport.pdf.

8. “Changing Climates: The Heat Is (Still) On,” accessed January 31, 2025, https://www.swissre.com/dam/jcr:cdbae8ed-24d0-4ec8-ad49-14f16846e556/2024-02-28-sri-expertise-publication-changing-climates-heat-still-on.pdf.

9. Asian Development Bank, Asia-Pacific Climate Report 2024: Catalyzing Finance and Policy Solutions, 0 ed. (Manila, Philippines: Asian Development Bank, October 2024), https://doi.org/10.22617/SGP240498-2.

10. Government of the Philippines, 2022 Budget at a Glance (Enacted), accessed February 6, 2025, https://www.dbm.gov.ph/wp-content/uploads/Our%20Budget/2022/2022-Budget-at-a-Glance-Enacted-English-Briefer.pdf.

11. Government of the Philippines, 2023 Budget at a Glance (Enacted), accessed February 1, 2025, https://www.dbm.gov.ph/wp-content/uploads/Our%20Budget/2023/2023-Budget-at-a-Glance-Enacted.pdf.

12. Ibid., PH 2024 National Budget, 2024, 2.

13. Government of the Philippines, FY 2025 Budget at a Glance, accessed February 1, 2025, https://www.dbm.gov.ph/wp-content/uploads/Our%20Budget/2025/FY-2025-Budget-at-a-Glance.pdf.

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