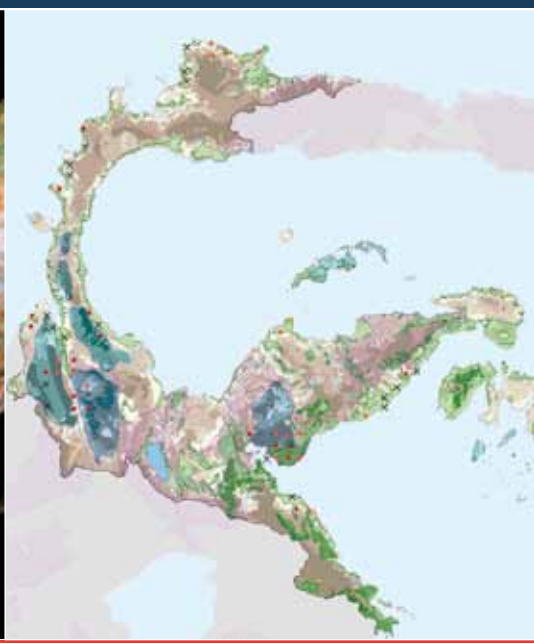
Using spatial information to promote multiple benefits from REDD+ in Indonesia

A compendium of maps for Central Sulawesi Province



UNEP WCMC

UN-REDD PROGRAMME

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The UN-REDD Programme is the United Nations collaborative initiative on Reducing Emissions from Deforestation and forest Degradation (REDD+) in developing countries. The Programme was launched in 2008 and builds on the convening role and technical expertise of the Food and Agriculture Organization of the United Nations (FAO), the United Nations Development Programme (UNDP) and the United Nations Environment Programme (UNEP). The UN-REDD Programme supports nationally-led REDD+ processes and promotes the informed and meaningful involvement of all stakeholders, including Indigenous Peoples and other forest-dependent communities, in national and international REDD+ implementation.

The UNEP World Conservation Monitoring Centre (UNEP-WCMC) is the biodiversity assessment and policy implementation arm of the United Nations Environment Programme (UNEP), the world's foremost intergovernmental environmental organization. The Centre has been in operation since 1979, combining scientific research with practical policy advice.

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Cover: *Agricultural landscape against background of natural forest, Central Sulawesi.* © Ulf Narloch, UNEP-WCMC. *Spectral tarsier (Tarsius spectrum) on a log in the rainforest, Sulawesi.* © Specialist Stock. *Map of important areas for biodiversity in Central Sulawesi.* © UNEP-WCMC

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A compendium of maps for Central Sulawesi Province

Simon Blyth, Corinna Ravilious, Judin Purwanto, Cordula Epple, Valerie Kapos, Henry Barus, Hasbi Afkar, Adi Setyawan and Blaise Bodin

Contents

1. Introduction

The success of REDD+ actions[1] will depend to a substantial degree on the selection of appropriate locations for their implementation. This is particularly true if success is defined not only in terms of maintaining or enhancing carbon stocks, but also in terms of achieving additional social and environmental benefits, such as conservation of biodiversity and ecosystem services or promoting local livelihoods.

The type and amount of benefits that REDD+ can deliver vary from one location to another. They are influenced by a range of biophysical, geographic, socio-economic and cultural factors. Spatial information related to these factors can therefore be very useful to decision-makers who are involved in planning for multiple benefits from REDD+.

Maps can support decision-making processes by conveying spatial information in an easily accessible way. They can be used as a basis for communication with stakeholders as well as for simple visual analyses of the spatial relationship between different relevant parameters. Unfortunately, the availability of high-resolution, accurate and up-to-date spatial information is often limited. In most cases it will therefore be necessary to back up the conclusions reached on the basis of the available spatial datasets through consultation of local knowledge and field checks before making a final decision about the selection of sites for a particular action.

The maps shown in this brochure have been developed as part of a decision-support toolkit for REDD+ planning in the Indonesian province of Central Sulawesi. They have been designed to support the development of plans for REDD+ actions that provide multiple benefits in line with the needs of different stakeholder groups. The set is composed of two carbon maps (a map of biomass carbon and a map of combined biomass and soil carbon stock), four maps showing potential areas for different types of REDD+ actions (given the fact that different actions are appropriate for different locations), and a series of additional data layers. These additional layers can be used to support further prioritization based on selected criteria. By combining the layers and base maps using GIS, the maps can be customized according to the requirements of the users. In this brochure, all of the additional data layers are displayed against the background of the map of total carbon.

All maps in this brochure were developed based on the best available data at the time, and should be updated when newly collected datasets become available.

2. Planning for REDD+ in Central Sulawesi Province

Central Sulawesi is the largest province on Sulawesi island, situated in the heart of the Republic of Indonesia on the equator line. A total of 64.4% of the province area is part of the official state forest area (*Kawasan Hutan*), and thus under the authority of the Ministry of Forestry.

Historically, the rate of deforestation and forest degradation has been lower in Sulawesi than on other Indonesian islands like Sumatra and Kalimantan.

Natural forest in Lore Lindu National Park, Central Sulawesi. © Marion Mehring.

1 REDD+ is an approach to climate change mitigation that aims to Reduce Emissions from Deforestation and forest Degradation, to manage forests sustainably and to conserve and enhance forest carbon stocks.

However, there has been an increase in recent years, which is largely due to land conversion for agriculture. At present, around 0.4% of the forest area is lost each year, and 1.14% is degraded[2].

The forests of Central Sulawesi provide a number of ecosystem services that are of specific global or local significance.

Sulawesi is well known for its unique biodiversity, and has been highlighted as an area of global importance for biodiversity conservation[3]. The island is situated at the biogeographical crossroads between East Asia and Australasia and characterized by high levels of endemism among plant and animal species. Taxonomic inventories have so far been limited and it is likely that a large part of the fauna and flora harboured by Sulawesi's forests is still unknown.

Because of the mountainous topography with elevations of up to 3,300 m and the humid tropical climate with an average rainfall of up to 3,000 mm per year, forests in Central Sulawesi have an important role in protecting soils and regulating the water cycle.

There is also a large potential for social benefits from REDD+ in Central Sulawesi, as around 800,000 people (or some 33% of the total population of the province) live in and around the forest. At almost 16%, the proportion of the population below the poverty line is higher in Central Sulawesi than the national average. Agriculture provides jobs to nearly 60% of the total working age population, among them many of the rural poor.

In July 2010, Central Sulawesi was officially appointed as the pilot province for the UN-REDD Programme in Indonesia. A Provincial REDD+ Working Group was established in February 2011 to support the preparations for REDD+ implementation. The Working Group includes representatives of government agencies, forestry companies, academia, NGOs, and indigenous people and local communities. A Provincial Strategy for REDD+ Implementation is currently under development, and it is expected that the governments of the 10 districts in Central Sulawesi will elaborate their own REDD+ strategies in due course. Due to the large number of government agencies and other stakeholders who are involved in REDD+ planning, transparent and effective decision-making processes and accessibility of decision-relevant information are of great importance.

3. Development and suggested use of the maps of biomass carbon and total carbon

The **biomass carbon** dataset (see map on p. 10) was developed on the basis of land cover data for 2009 obtained from the Ministry of Forestry of Indonesia. Carbon values for each land cover category were assigned based on a literature search of published biomass values. As the category 'secondary forest' includes forests of widely varying degrees of disturbance, it was further stratified using a land cover dataset for 2005 that was produced under the ALLREDDI project[4].

The map of **total carbon** (see p. 11) was created by combining the biomass carbon map with soil carbon values extracted from a global map of terrestrial soil organic carbon stocks.

Which of the two maps is most appropriate as a basis for REDD+ decision-making depends on the scale of planning, on the type of actions planned, as well as on the availability of methods for measuring or calculating changes in soil carbon.

As the resolution of the biomass carbon data is higher than that of the soil carbon dataset, it can be advisable for planning at finer scales to use only the biomass carbon map.

The relevance of the different carbon datasets for planning also varies between different REDD+ actions. Including information on soil carbon can be useful when planning actions to reduce emissions from deforestation or forest degradation and to manage forests sustainably, as land clearance or unsustainable forest management often lead to a significant release of soil carbon in the medium term. By contrast, the potential of different locations for actions to enhance forest carbon stocks can most easily be assessed by looking at the current biomass carbon values only (see also section 4).

Where methods to monitor or model changes in soil carbon stock are not available, decisions that need to take account of the economic viability of REDD+

2 Source: draft of the Provincial REDD+ Strategy, 2012.

3 See Cannon, C.H., Summers, M., Harting, J.R., Kessler, P.J.A. (2007): Developing Conservation Priorities Based on Forest Type, Condition, and Threats in a Poorly Known Ecoregion: Sulawesi, Indonesia. Biotropica 39(6): 747–759.

4 For a full citation of the sources used in both carbon maps, see the legend of the respective maps.

actions may be better informed by looking at biomass carbon stock only, as it seems likely that it will not be possible to obtain REDD+ credits for maintaining or enhancing soil carbon stocks if the results cannot be demonstrated. However, ignoring the benefits that REDD+ actions create in terms of soil carbon will reduce the potential income from REDD+ payments.

4. Development and suggested use of the maps showing potential areas for different types of REDD+ actions

For the purpose of identifying possible areas for the implementation of different REDD+ actions, the wide range of available options for action was divided into four broad categories:

1. Actions to maintain existing forest (by protecting it from timber extraction, conversion or other pressures)
2. Actions to manage forests sustainably (e.g. by changing to less harmful harvesting methods or lower timber extraction rates)
3. Actions to rehabilitate forests (e.g. through enrichment planting or by protecting sites against further pressure to allow natural regeneration)
4. Actions to establish plantations or agroforestry (on non-forest land).

The steps undertaken to produce the maps and the reasons behind the selected approaches are described below. The maps are intended to serve as a first orientation for planning REDD+ actions and it is assumed that additional information on the areas identified as possible locations would be collected at a later stage in the planning process.

Potential areas for maintaining forest (see flowchart on p. 12 and map on p. 13):

The selection of sites for actions to maintain forest should be based on consideration of the existing carbon stock (the higher the current carbon stock, the higher the potential carbon benefit); the importance of the site for biodiversity and ecosystem services; the amount of anthropogenic pressure on the forest; and whether appropriate means are available to reduce this pressure without putting local livelihoods at risk or causing the displacement of activities to other areas. Where pressures can be addressed successfully, areas that are currently exposed to strong pressure will provide higher carbon benefits.

The following steps were taken to produce the map:

1. Based on the land cover data, areas that are at present covered by forest were identified. All other areas were blanked out.

2. For the identified forest areas, the values of total carbon stock are shown.

The resulting map can give decision-makers and planners an indication of where actions to maintain forest could provide the highest carbon benefits (areas of high carbon stocks) and where they are not possible (areas without forest cover). If combined with further data layers (e.g. important areas for biodiversity as shown on p. 24, or areas with high population density as shown on p. 26) the map can be used to assess the potential for additional social and environmental benefits, as well as the risk of trade-offs with economic activities. Adding information related to pressures (e.g. location of roads or areas of recent deforestation, see pp. 30 and 29) can help to identify where specific actions are needed if the forest is to be maintained, and what they could be.

Potential areas for managing forests sustainably (see flowchart on p. 14 and map on p. 15):

The selection of sites for actions to manage forests sustainably should be based on consideration of current and planned forest use (actions to promote sustainable management can only bring carbon benefits in areas that would otherwise be used less sustainably); existing carbon stock (in most cases potential carbon benefits are greatest where current carbon stock is high); the importance of the site for biodiversity and ecosystem services; and the potential for obtaining livelihood benefits.

The following steps were taken to produce the map:

1. Based on the land cover data and the map of legally designated forest functions (see p. 22), areas that are not available for sustainable forest management activities under REDD+ were blanked out. These areas are non-forest areas and those parts of the state forest area that are designated as conservation areas or protection forest (as logging is not legally permitted in these locations).

2. For all remaining areas (areas designated as production forest and forest areas outside of

state forest land), the values of total carbon stock are shown.

3. Areas covered by existing timber concessions were highlighted.

The resulting map can give decision-makers and planners an indication of where actions promoting sustainable management of forests could provide the highest carbon benefits (areas of high carbon stocks located within existing concessions), where they are unlikely to produce carbon benefits (production forests not presently covered by concessions) and where they are not possible (areas without forest cover, conservation areas and protection forest). If combined with further data layers (e.g. important areas for biodiversity as shown on p. 24, or areas where frameworks for community involvement in forest management are in place, see p. 32) the map can be used to assess the potential for additional social and environmental benefits.

Potential areas for forest rehabilitation (see flowchart on p. 16 and map on p. 17):

Forest rehabilitation is defined here as the re-establishment of forest cover on a degraded site with the aim to restore productivity and at least some of the plant and animal species that were originally present at the site. Rehabilitation activities therefore differ in aims and methods from the establishment of plantations (see below). The methods for rehabilitation should be selected in accordance with the condition of soils and vegetation[5]. The selection of sites for rehabilitation should be based on consideration of the existing carbon stock (the lower the current carbon stock, the higher the potential carbon benefit); the status of the soil (on severely degraded soils, rehabilitation will be more difficult and costly but also more beneficial in terms of ecosystem services and livelihood opportunities); competing demands on the land and local demand for forest products; and the importance of the site for biodiversity and ecosystem services, including the regulation of water flows and water quality in downstream areas. The classification of degraded areas as 'critical land' by the Indonesian authorities for watershed management gives an indication of the level of damage to soils that has already occurred, and of the importance of the site for maintaining water quality and regulating water flows.

The following steps were taken to produce the map:

1. Based on the land cover data, areas that are not suitable for rehabilitation activities were blanked out. These areas are primary forests (no rehabilitation potential), settlements (not available for rehabilitation) and tree plantations (likely to be unavailable for forest rehabilitation and comparatively low potential for enhancing carbon stocks).
2. Agricultural areas were marked through hatching, as these areas have a high potential for enhancement of carbon stocks, but are unlikely to be available for forest rehabilitation activities due to their importance for the local economy and food production.
3. Based on the map of biomass carbon stocks, areas with low carbon stocks (i.e. high potential for enhancing carbon stocks through forest rehabilitation) were highlighted.
4. Based on the map of critical lands, areas that are considered to be very critical, critical and moderately critical (i.e. high potential for enhancing carbon stocks and protecting soils through forest rehabilitation) were highlighted.

The resulting map can give decision-makers and planners an indication of where actions to rehabilitate forests would be most desirable from the perspective of soil and water resources conservation (critical lands), where they could provide the highest carbon benefits (areas of low carbon stocks and critical lands), where they could provide high carbon benefits but might incur trade-offs with economic activities (agricultural areas), where they might be possible, but would only provide smaller carbon and soil conservation benefits (secondary forest with intermediate carbon stocks; these areas may be able to recover without human intervention), and where they are not possible (primary forest, settlements and plantations). Further data layers can be added to assess the potential for other social and environmental benefits.

Potential areas for the establishment of plantations or agroforestry (see flowchart on p. 18 and map on p. 19):

It is possible to enhance carbon stocks on non-forest land by establishing plantations of timber species or tree crops, or by introducing agroforestry methods. However, it is not yet clear whether rules for carbon accounting under REDD+ will allow plantations and agroforestry systems to be classed as 'forest' in Indonesia, and thus whether their carbon stocks will be included in the calculation of REDD+ carbon outcomes. But even if some or all types of plantations and agroforestry systems are excluded from carbon accounting, they can still have a role in REDD+ as part

5 See also the document "Options for REDD+ action: what are their effects on forests and people? An introduction for stakeholders in Central Sulawesi", available at http://www.un-redd.org/MultipleBenefitsPublications/tabid/5954/Default.aspx

Rice field near Lore Lindu National Park, Central Sulawesi. Agricultural land is often unavailable for REDD+ actions to enhance forest carbon stock. © Marion Mehring.

of a strategy to reduce pressure on natural forests by providing alternative sources of income and livelihoods, as well as food, timber and non-timber forest products. If they are designed and managed appropriately, they can also have positive impacts on biodiversity and ecosystem services[6]. The selection of sites for plantations and agroforestry should be based on consideration of the existing carbon stock (the lower the current carbon stock, the higher the potential carbon benefit), the status of the soil (on degraded soils, establishment of plantations and agroforestry will be more difficult and costly but also more beneficial in terms of ecosystem services and livelihood opportunities); competing demands on the land; and the characteristics of the existing vegetation (the conversion of natural forest vegetation to plantations would be in breach of agreed REDD+ safeguards[7]).

The following steps were taken to produce the map:

1. Based on the land cover data, areas that are not considered suitable for plantations or agroforestry under REDD+ were blanked out. These areas are all natural forests (conversion to plantations or agroforestry would conflict with REDD+ safeguards), swampland (conversion to plantations or agroforestry is likely to cause net carbon emissions and thus counteract the aims of REDD+), settlements (not available for plantations and agroforestry) and already existing plantations.
2. Agricultural areas were marked through hatching; these areas have a high potential for enhancement of carbon stocks, but may not be available for timber plantations due to their importance for the local economy and food production; some agricultural lands may be available for tree crop plantations or expansion of agroforestry.
3. Based on the map of biomass carbon stocks, areas with low carbon stocks (i.e. high potential for enhancing carbon stocks through plantations or agroforestry) were highlighted.
4. Based on the map of critical lands, areas that are considered to be very critical, critical and moderately critical (i.e. that have some potential for enhancing carbon stocks and protecting soils through plantations and agroforestry systems if these are suitably managed) were highlighted.

The resulting map can give decision-makers and planners an indication of where suitably managed plantations and agroforestry could make a contribution to soil and water resources conservation

6 See "Options for REDD+ action: what are their effects on forests and people? An introduction for stakeholders in Central Sulawesi", http://www.un-redd.org/MultipleBenefitsPublications/tabid/5954/Default.aspx

7 See http://unfccc.int/resource/docs/2010/cop16/eng/07a01.pdf, p. 12 ff. and http://www.unredd.net/index.php?option=com_docman&task=doc_download&gid=6985&Itemid=53

(critical lands), where they could provide the highest carbon benefits (areas of low carbon stocks and critical lands), where they could provide high carbon benefits but might incur trade-offs with other economic activities (agricultural areas), and where they are not considered suitable (natural forest, swampland, settlements and existing plantations). Further data layers can be added to assess the potential for other social and environmental benefits.

5. Additional data layers and their possible uses in REDD+ planning

One important type of background information for REDD+ planning is related to the legal designations of the different forest areas and the administrative responsibilities for their management, as these frameworks determine what actions can be carried out, promoted, permitted and/or restricted in a certain location and who has the power to decide upon them.

The data layer showing the **boundary of the state forest area** (see maps on p. 20 and p. 21) can be used to identify the potential roles of different authorities in REDD+ implementation. Regardless of actual land cover, land use within the designated state forest area comes under the authority of the Ministry of Forestry. Some parts of the designated state forest area are actually without forest cover and could thus be a target for rehabilitation activities rather than for forest conservation or sustainable management. At the same time, substantial tracts of forest exist outside of the state forest area. These forests can play an important role in REDD+ strategies, if the consent and engagement of local governments and other stakeholders can be secured.

The **designated functions** of forests within the state forest area, as shown on p. 22, are determined by the Ministry of Forestry based on the natural characteristics of the forest and its role in supplying forest products, in preserving hydrological processes, soil fertility and other life-supporting ecosystem functions, as well as in preserving ecosystems and plant and animal diversity. There are three main types of designated forest functions. In conservation areas, the most important function is the conservation of ecosystems and biological diversity. Protection forests are mainly designated for the protection of ecosystem services related to hydrology, flood prevention, erosion control, maintaining soil fertility and preventing sea water intrusion. In production forests, supplying forest products is considered the main function. Utilization of timber is only permitted in production forests, subject to the granting of an appropriate business license.

Conservation areas and protection forests can be relevant for REDD+ implementation in various ways. If they are already managed and protected in a suitable manner, the carbon stocks within them can be considered as relatively secure. However, if their management is not yet sufficiently effective or if parts of the forest have already been degraded, improving management and restoring the forest can be REDD+ actions that provide additional benefits for biodiversity and ecosystem services. Possible REDD+ actions in production forests include promoting more sustainable forms of forest management, halting timber extraction in some parts of the area (e.g. by buying back existing concessions or ceasing to issue new concessions), rehabilitating degraded areas or changing the forest status to a more strictly protected forest function.

The establishment of **Forest Management Units** (FMU) is an ongoing process in Indonesia. Once they are fully operational, the Forest Management Units will form the basic administrative units for all management of forest resources. One or more forest functions (conservation, protection and production) can be included in a Forest Management Unit, but the classification of the unit will be determined by its dominant forest function. The map on p. 23 shows the boundaries of Forest Management Units in Central Sulawesi. One Forest Management Unit, the Model FMU Dampelas Tinombo, has already been equipped with a management plan.

The establishment and institutional strengthening of Forest Management Units are important steps towards improved forest governance and as such play a key role in current plans for REDD+ implementation in Central Sulawesi Province. Information on the carbon stocks within the different units can help to identify REDD+ actions that are most appropriate to each unit and could be reflected in its management plan (e.g. reducing deforestation vs. restoring forest), and to identify Forest Management Units that could be prioritized when selecting areas for REDD+ implementation.

While information on legal status and administrative responsibilities is necessary to identify available options and responsible authorities for planning REDD+ action, spatial data on the relative importance of different forest areas for multiple benefits is crucial for prioritizing actions in a way that supports these benefits. Unfortunately, a shortage of up-to-date

environmental and socio-economic data is often a major limitation for this kind of analysis.

The map on p. 24 displays several data layers that can be used to assess the importance of different areas for **biodiversity conservation**.

Important Bird Areas are identified nationally based on criteria developed by BirdLife International. They are considered to have a particular importance for the conservation of birds due to the presence of large numbers of endangered species and/or the fact that the sites contain key habitat or resources for a large share of the world population of some species.

The conservation portfolio priority sites identified by The Nature Conservancy were selected based on an ecoregional conservation assessment that was conducted by a team of international and Indonesian scientists and stakeholders from 2003 to 2005. The sites are considered to have key importance for conservation management and were identified based on criteria of representativeness, irreplaceability, functionality, resilience, connectivity, degree of disturbance and level of endangerment.[8]

The data layer showing the potential distribution range of endangered forest types has been developed based on a classification of forest types for Sulawesi according to the soil types and altitudinal zones where they occur, and on an assessment of the percentage of forests of each type that is still in good to very good condition. Those forest types of which only few intact areas remain were classified as endangered. Any remaining good quality forests within the distribution range of endangered forest types are thus of particular importance for conservation.

*Adult maleo bird (*Macrocephalon maleo*).* © Stavenn Maleo

The nesting grounds of the endemic maleo bird (*Macrocephalon maleo*), which incubates its eggs in soils heated by the sun or by volcanic activity, are vulnerable to disturbance. Many known sites have been abandoned by the birds, which contributes to the classification of the maleo as an endangered species. The maleo is considered a flagship species for Sulawesi and plays a role in traditional culture.

REDD+ actions can provide additional benefits for biodiversity conservation if efforts to maintain natural forest are prioritized in areas of high biodiversity value and/or in their surroundings (thus providing buffer zones or enhanced connectivity with other forests). If forests in areas of importance for biodiversity have been degraded, restoration using appropriate methods (e.g. natural regeneration or enrichment planting with mixed native species) can also be a beneficial option.

Due to Central Sulawesi's mountainous topography, **erosion control** is a key environmental service provided by its forests. On steep slopes, deforestation or forest degradation can lead to loss of the fertile topsoil layer, as well as to higher sediment loads in rivers and streams. Another negative consequence can be increased surface water runoff after heavy rainfalls, leading to higher peak flows in rivers and increased risk of flooding.

The map on p. 25 displays two data layers (slope and watershed boundaries) that can help to assess the importance of forests for erosion control. While slope is a decisive factor determining the risk of soil loss after the forest is disturbed, the negative impacts that erosion has for people depend to some degree on the location of the slope in relation to the nearest watercourse, and on the amount of sensitive assets like cultivated areas, settlements, transport infrastructure or dams that are situated along that watercourse. The watershed boundaries shown on the map make it possible to see which forest areas drain into a particular river system. REDD+ benefits to local populations can be enhanced by prioritizing actions to maintain and restore forest cover on steep slopes or

8 For more detail on the selection process, see Cannon, C.H., Summers, M., Harting, J.R., Kessler, P.J.A. (2007): Developing Conservation Priorities Based on Forest Type, Condition, and Threats in a Poorly Known Ecoregion: Sulawesi, Indonesia. Biotropica 39(6): 747–759.

Flooding damage in a cocoa plantation, Central Sulawesi.
© Sunny Reetz, Georg-August-Universität Göttingen

in watersheds where valuable assets are at risk from sedimentation or flooding.

Information on **population density** and **population growth** (see maps on pp. 26 and 27[9]) can have several uses in REDD+ planning. It can give an indication of pressure on the forest, as forests in densely populated areas or areas with a high population growth rate may be exposed to particularly high pressure from subsistence uses or conversion. It can also indicate the potential to achieve benefits from REDD+ for local populations, as higher population density means that more people can benefit from enhanced ecosystem services or alternative income opportunities.

Knowing more about the prevalent economic activities among local people can help further to assess both the kinds of pressure on the forest that are to be expected and the kinds of benefits that REDD+ can deliver. For example, the percentage of the population that is engaged in **farming** (see map on p. 28), together with the information on population density and growth, can indicate areas where REDD+ strategies may need to pay special attention to actions that reduce conversion pressure without endangering local livelihoods. Possible approaches to achieve this include promotion of alternative sources of income, increasing community involvement in forest management (see also the map on p. 32), making farming methods more sustainable, and rehabilitating degraded land in order to increase the area that is available for agriculture and forestry.

Other ways to identify forest areas where particular pressures may need to be addressed are to look at the relationship between high carbon areas and factors determining accessibility, such as the **road network** (see map on p. 30), or to scrutinize areas where **deforestation** has recently taken place (see map on p. 29). As deforestation often expands progressively, carbon stocks may be more vulnerable in areas close to recent deforestation than in other places. However, due to the rugged landscapes of Central Sulawesi, the prevailing deforestation pattern is quite patchy and the topography should be considered when trying to assess whether a particular area is likely to be affected by the spread of deforestation.

Last but not least, REDD+ planning also needs to consider existing rights to the use of forest land and their implications for the future of carbon stocks (see maps of **concessions** and officially approved sites for **community involvement in forest use** on pp. 31–33).

While some uses, like **mining** and **conversion to agriculture or transmigration settlements**, invariably lead to carbon emissions, the use of **timber and non-timber forest products** can be compatible with maintaining carbon stocks if it is carried out sustainably. The possibilities for addressing existing use rights in REDD+ planning are manifold and include:

- accepting them as fixed and focusing REDD+ efforts on other areas,
- providing incentives for the application of the most sustainable utilization methods available in order to reduce carbon emissions and other environmental damage, or
- entering into discussions with the rights holders in order to agree land swaps from areas of high carbon density or high potential for multiple benefits to areas of lower priority for REDD+, or to agree on a form of compensation (e.g. in the form of a payment for ecosystem services) for not exercising the use rights or replacing the activities that were originally planned (e.g. logging) with actions that are more favourable to the aims of REDD+ (e.g. forest restoration).

Arrangements for community involvement in forest use have the potential to play a particular role in REDD+, as they can increase the livelihood benefits

9 As no direct information on population growth rates could be obtained at an appropriate spatial resolution, a data layer about the percentage of children in the population is shown on the map as a proxy. Although the percentage of children can give an indication of population trends, it should be noted that this indicator cannot reflect the full picture, since it gives no information about other relevant factors like migration to and from the area.

for local communities, promote local ownership and acceptance of REDD+, and draw on local and traditional knowledge about the forest and ways to manage it sustainably, as well as about local biodiversity and potential for ecosystem services.

Three important types of arrangements for community involvement are shown on the maps on pp. 32 and 33: village forests, community forests and people's plantations.

The designation of **village forests** (*hutan desa*) allows village-based institutions to obtain a license to manage and protect state forest lands. In production forest areas, commercial exploitation of timber can be permitted.

The establishment of **community forests** (*hutan kemasyarakatan*) involves the granting of rights for the use of non-timber forest products to community-based groups. They are usually established on land in need of rehabilitation.

People's plantations (*hutan tanaman rakyat*) can be established on degraded production forest land and allow the members of community groups to plant trees and sell the timber and other products obtained.

REDD+ implementation can build on the experiences gained in areas where these instruments are already being applied in order to strengthen their contribution to the conservation and sustainable management of forests and the enhancement of forest carbon stocks.

6. Outlook

As described in this report, the maps that have been developed as part of the decision-support toolkit for multiple benefits from REDD+ in Central Sulawesi can be used in a variety of ways to facilitate REDD+ planning.

Building on this work, a number of steps could be taken in the future to develop the datasets further and expand their application.

One way to promote uptake of the information contained in the maps would be to feed them into a process for agreeing a spatially explicit plan for REDD+ implementation. Together with information on other sectoral plans, this could lay the foundation for a discussion on an integrated plan for sustainable land use that is accepted across sectors.

Some of the datasets could also be used as an input to the development of a monitoring system that provides information on the impacts of REDD+ on multiple benefits. Such a system is necessary to ensure that the interventions are having the intended effects on biodiversity, ecosystem services and livelihoods. It can also be used to develop the information that is needed to comply with the UNFCCC decisions on social and environmental safeguards for REDD+[10], as well as with the national framework for the implementation of safeguards that is currently being created in Indonesia[11].

With regard to improving the data on which the maps are based, an important step towards increasing the accuracy of the carbon maps would be the development of a new soil carbon dataset by combining a national map of soil type distribution with information on soil carbon contents collected under the monitoring component of the UN-REDD Programme. A regular updating of the biomass carbon dataset with data collected following the recently developed methods for the system for Monitoring, Reporting and Verification (MRV) of carbon stock changes is also recommended.

As mentioned in the previous chapter, data on the spatial distribution of the potential for multiple benefits is generally scarce and several important ecosystem services could not be addressed in the current stage of the work. Priorities for improving the availability and quality of data should be agreed in consultation with users of the maps and REDD+ stakeholders in Central Sulawesi. Possible additional topics include the provision of timber and non-timber forest products, water flow regulation, pollination or the potential for poverty alleviation.

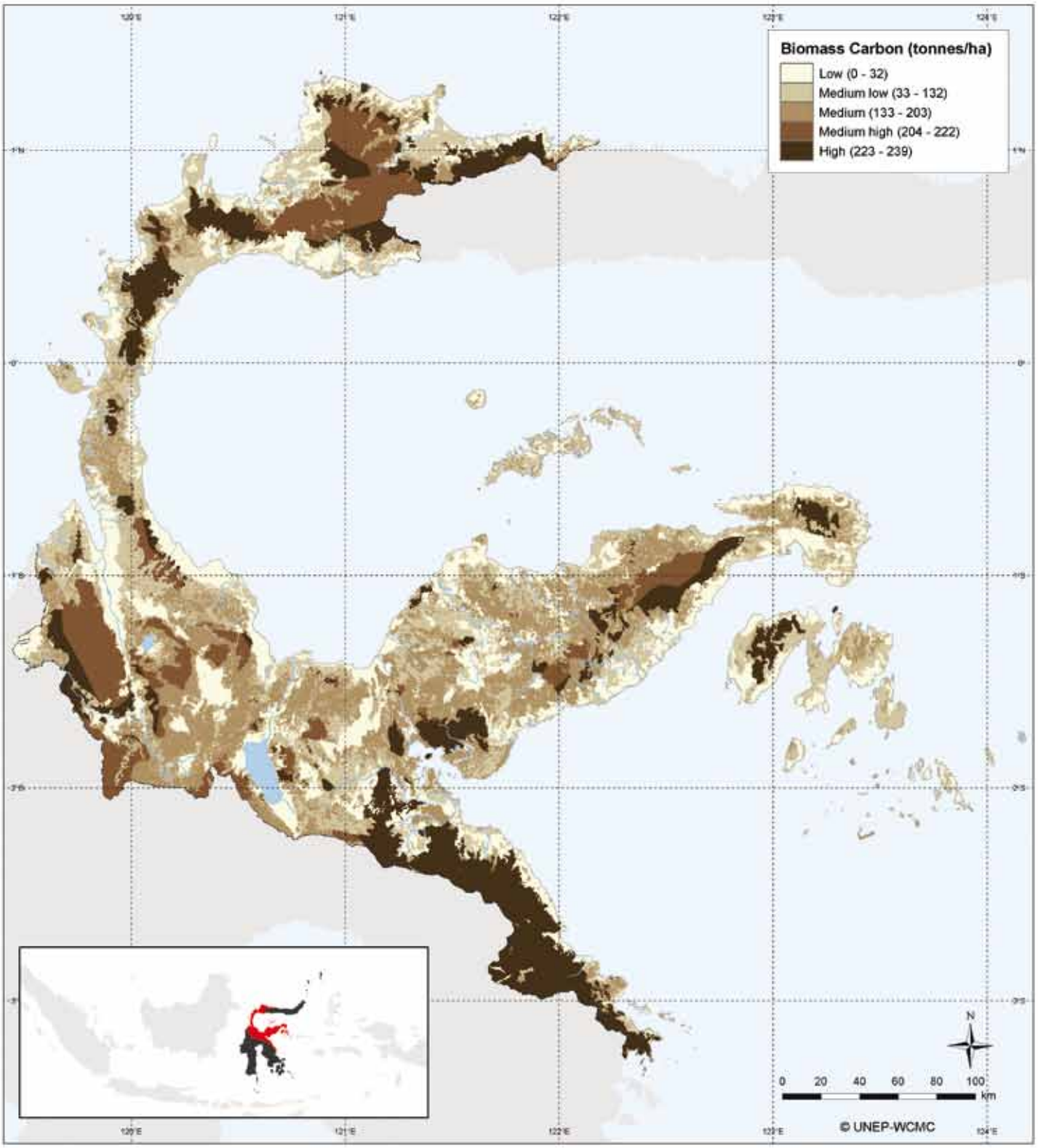
If appropriate input data are available, more sophisticated analyses could also be developed with the aid of modelling tools or planning software to answer specific questions that are of interest to decision-makers. For example, calculations could be made to obtain quantified estimates of the amount of carbon and other benefits that can be achieved through a proposed set of REDD+ actions. A description of available tools that can be used to support such analyses is included in the present set of publications[12].

10 See http://unfccc.int/resource/docs/2010/cop16/eng/07a01.pdf, p. 12 ff.

11 See http://forda-mof.org/files/Pengembangan%20PRISAI%20ComFoR.pdf

12 See the report "Strengthening benefits from REDD+ for biodiversity, ecosystem services and livelihoods – A guide to tools and resources that can help to plan for multiple benefits from REDD+ in Indonesia", which will be made available on the UN-REDD website at: http://www.un-redd.org/MultipleBenefitsPublications/tabid/5954/Default.aspx

Central Sulawesi Province - Biomass Carbon

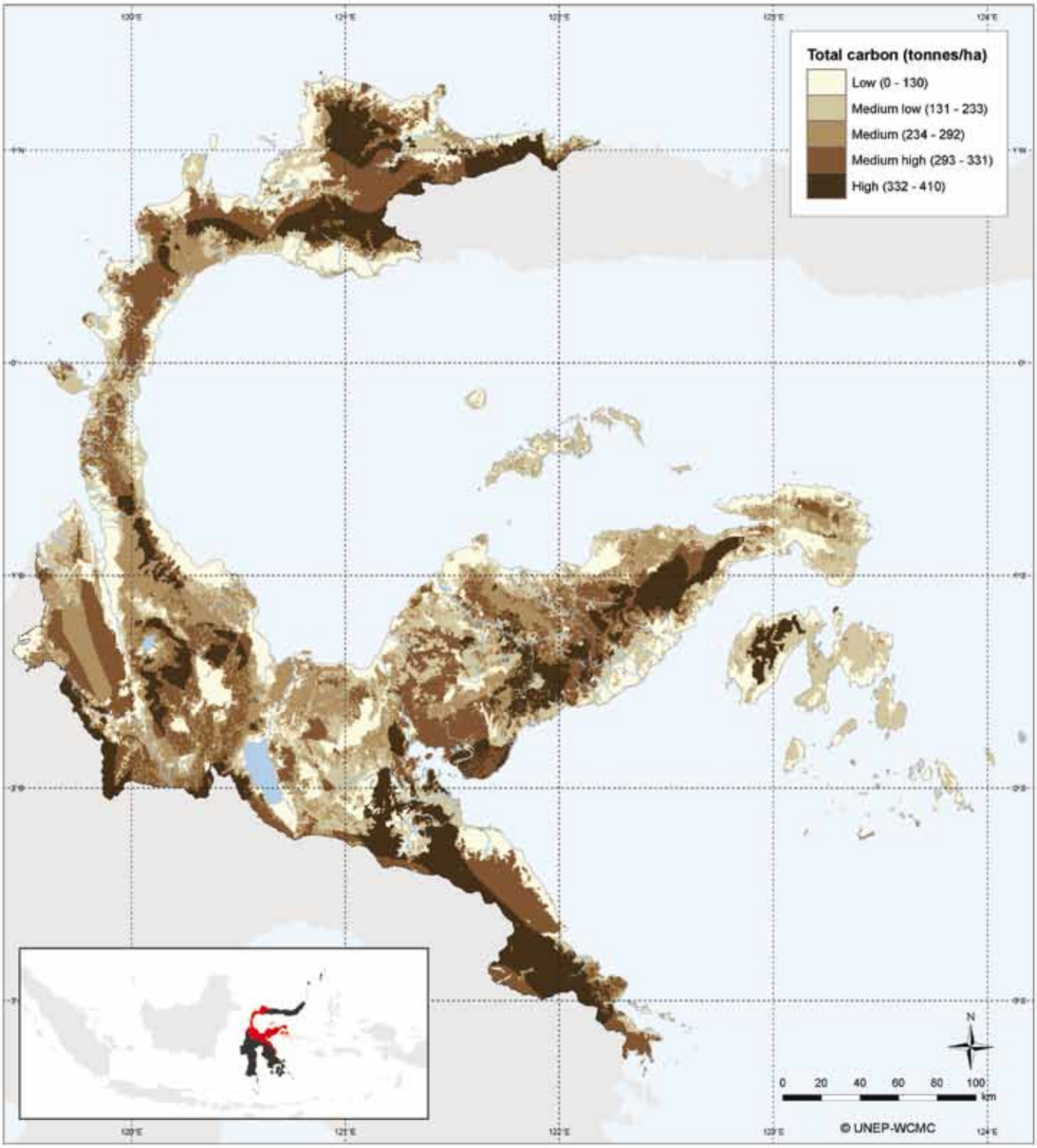


This map was produced for the UN-REDD programme in Indonesia in collaboration between UNEP-WCMC and the Ministry of Forestry of Indonesia, DG Forest Planning (Jakarta Office and Office for Forest Planning Region XVI), the Regional Forest Service Central Sulawesi and Tadulako University.

Method and Data Sources:
Biomass carbon: carbon values for each land cover category assigned based on a literature search of published biomass values; land cover category 'secondary forest' was further stratified into areas of lower to higher disturbance using data from the ALLREDDI land cover dataset for 2005. **Source:** Ministry of Forestry, DG Forest Planning (in prep.): Land cover dataset for Central Sulawesi interpreted from LandSat ETM 7+ images from 2008+2009. Land cover dataset for 2005 produced by ICRAF in cooperation with the Ministry of Forestry, Forestry Planning Agency, under the ALLREDDI project (see: Ekadinata, A., Widayati, A., Dewi, S., Rahman, S., van Noordwijk, M. (2011); Indonesia's land-use and land-cover changes and their trajectories (1990, 2000 and 2005). ALLREDDI Brief 01. Bogor, Indonesia. World Agroforestry Centre - ICRAF, SEA regional Office.
Base map: Land cover map for 2009 produced by the Ministry of Forestry

Central Sulawesi Province - Total Carbon

(Biomass carbon plus soil carbon)



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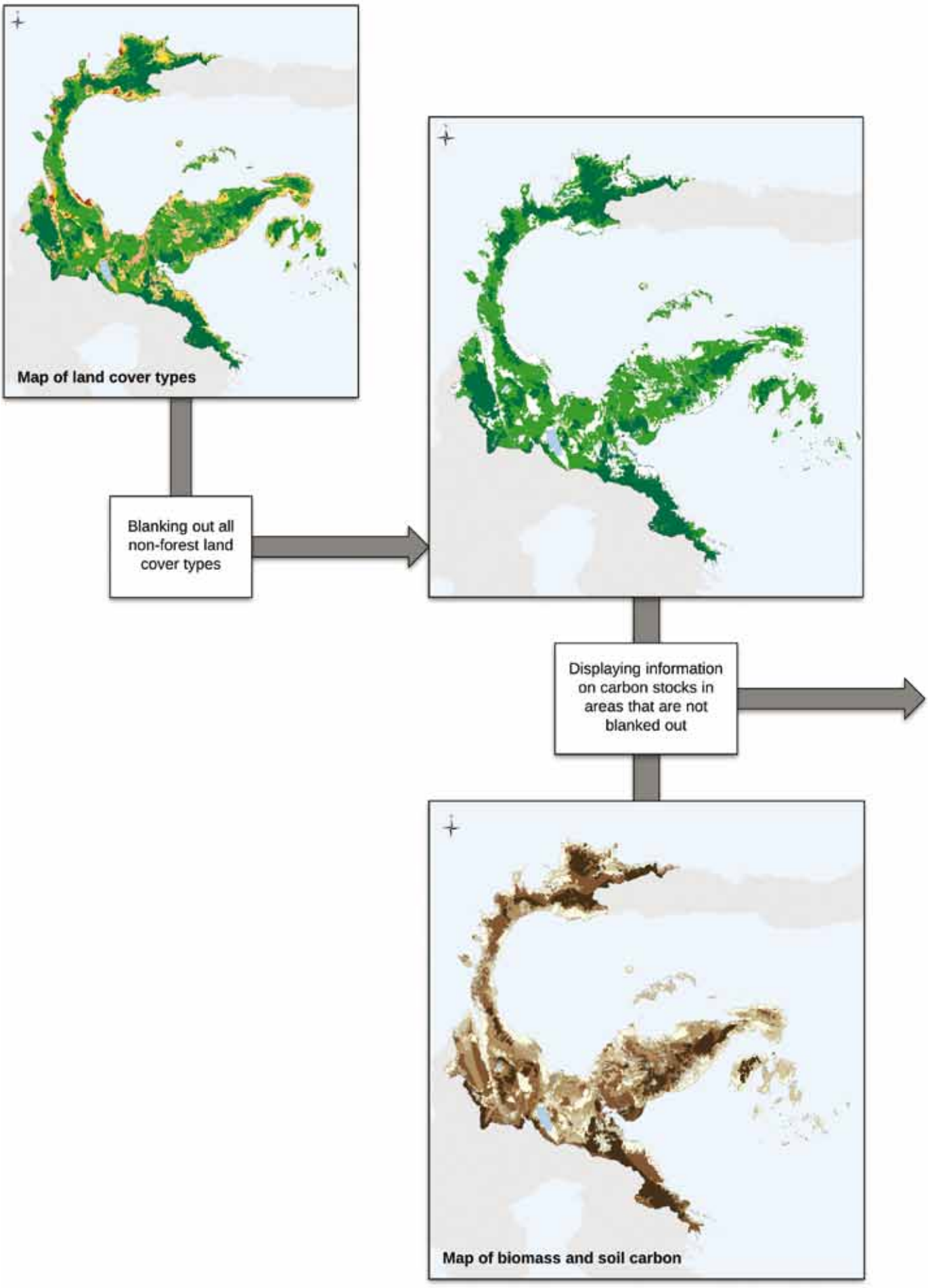
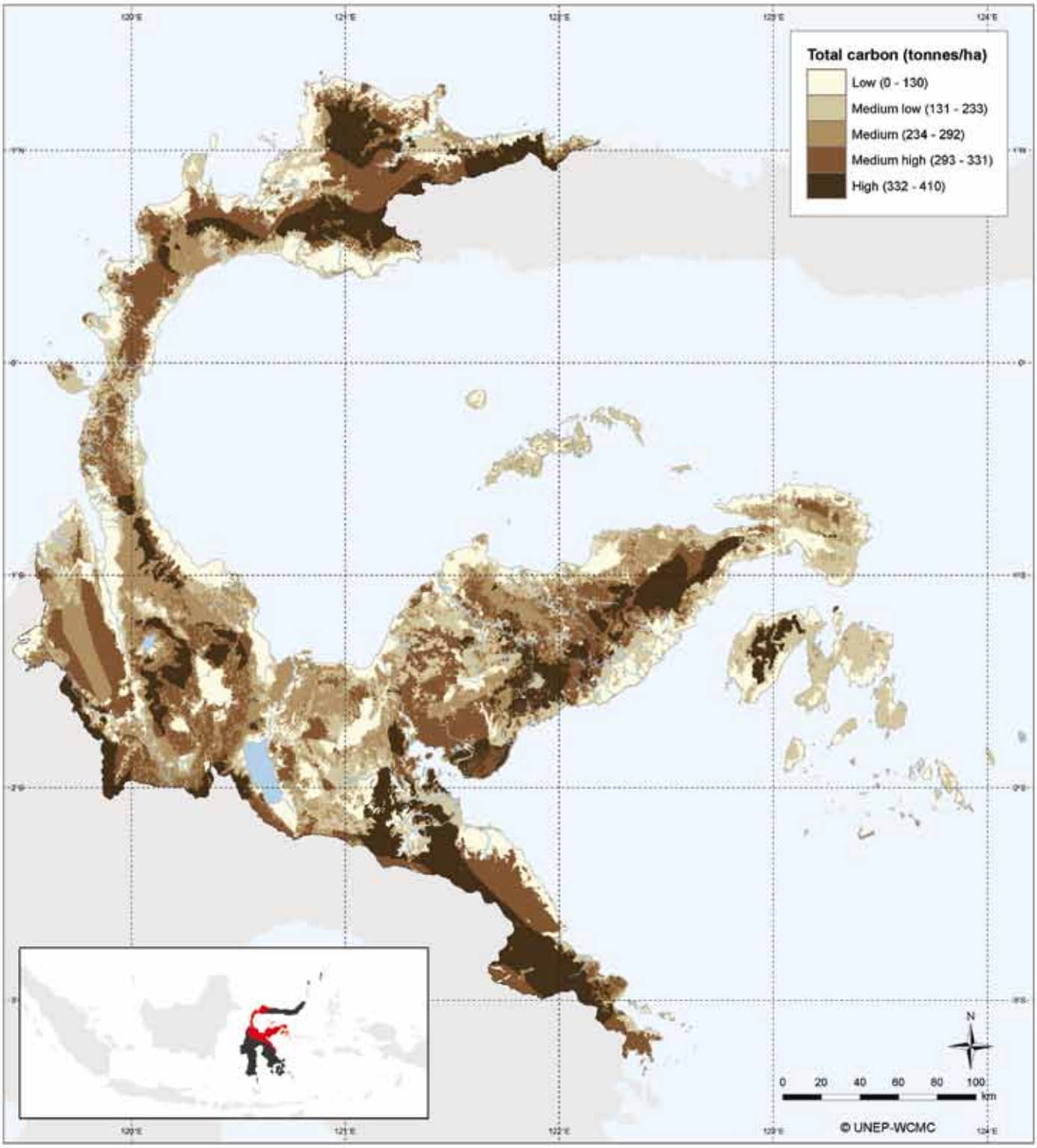
Method and Data Sources:
Biomass Carbon Method: Land cover map for 2009 produced by the Ministry of Forestry; carbon values for each land cover category assigned based on a literature search of published biomass values; land cover category 'secondary forest' was further stratified into areas of lower to higher disturbance using data from the ALLREDDI land cover dataset for 2005. **Source:** Ministry of Forestry, DG Forest Planning (in prep.): Land cover dataset for Central Sulawesi interpreted from LandSat ETM 7+ images from 2008+2009. Land cover dataset for 2005 produced by ICRAF in cooperation with the Ministry of Forestry, Forestry Planning Agency, under the ALLREDDI project (see: Ekadinata, A., Widayati, A., Dewi, S., Rahman, S., van Noordwijk, M. (2011): Indonesia's land-use and land-cover changes and their trajectories (1990, 2000 and 2005). ALLREDDI Brief 01. Bogor, Indonesia. World Agroforestry Centre - ICRAF, SEA Regional Office. **Soil Carbon Method:** Data for Central Sulawesi was extracted from the Global Soil Carbon Map. **Source:** Scharlemann, J.P.W., Hiederer, R., Kapos, V. (in prep.). Global map of terrestrial soil organic carbon stocks. UNEP-WCMC and EU-JRC, Cambridge, UK. **Combined biomass and soil carbon:** The biomass and soil carbon values were added to obtain an approximation of total ecosystem carbon.

Process used to identify potential areas for REDD+ actions to maintain forest



Central Sulawesi Province - Total Carbon

(Biomass carbon plus soil carbon)

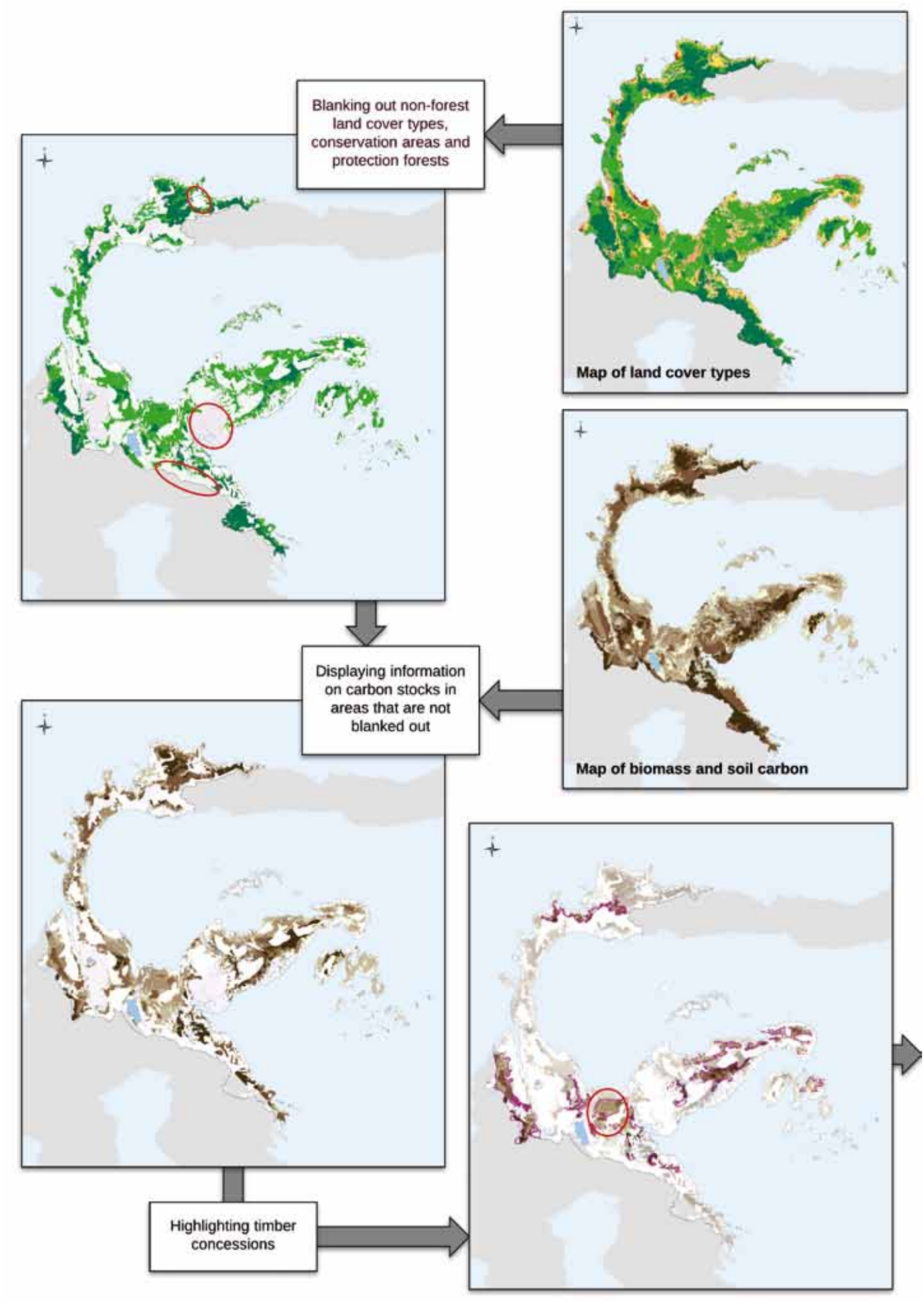


This map was produced for the UN-REDD programme in Indonesia in collaboration between UNEP-WCMC and the Ministry of Forestry of Indonesia, DG Forest Planning (Jakarta Office and Office for Forest Planning Region XVI), the Regional Forest Service Central Sulawesi and Tadulako University.

Method and Data Sources:
Biomass Carbon Method: Land cover map for 2009 produced by the Ministry of Forestry; carbon values for each land cover category assigned based on a literature search of published biomass values; land cover category 'secondary forest' was further stratified into areas of lower to higher disturbance using data from the ALLREDDI land cover dataset for 2005. **Source:** Ministry of Forestry, DG Forest Planning (in prep.): Land cover dataset for Central Sulawesi interpreted from LandSat ETM 7+ images from 2008+2009. Land cover dataset for 2005 produced by ICRAF in cooperation with the Ministry of Forestry, Forestry Planning Agency, under the ALLREDDI project (see: Ekadinata, A., Widayati, A., Dewi, S., Rahman, S., van Noordwijk, M. (2011): Indonesia's land-use and land-cover changes and their trajectories (1990, 2000 and 2005). ALLREDDI Brief 01. Bogor, Indonesia. World Agroforestry Centre - ICRAF, SEA Regional Office. **Soil Carbon Method:** Data for Central Sulawesi was extracted from the Global Soil Carbon Map. **Source:** Scharlemann, J.P.W., Hiederer, R., Kapos, V. (in prep.). Global map of terrestrial soil organic carbon stocks. UNEP-WCMC and EU-JRC, Cambridge, UK. **Combined biomass and soil carbon:** The biomass and soil carbon values were added to obtain an approximation of total ecosystem carbon.

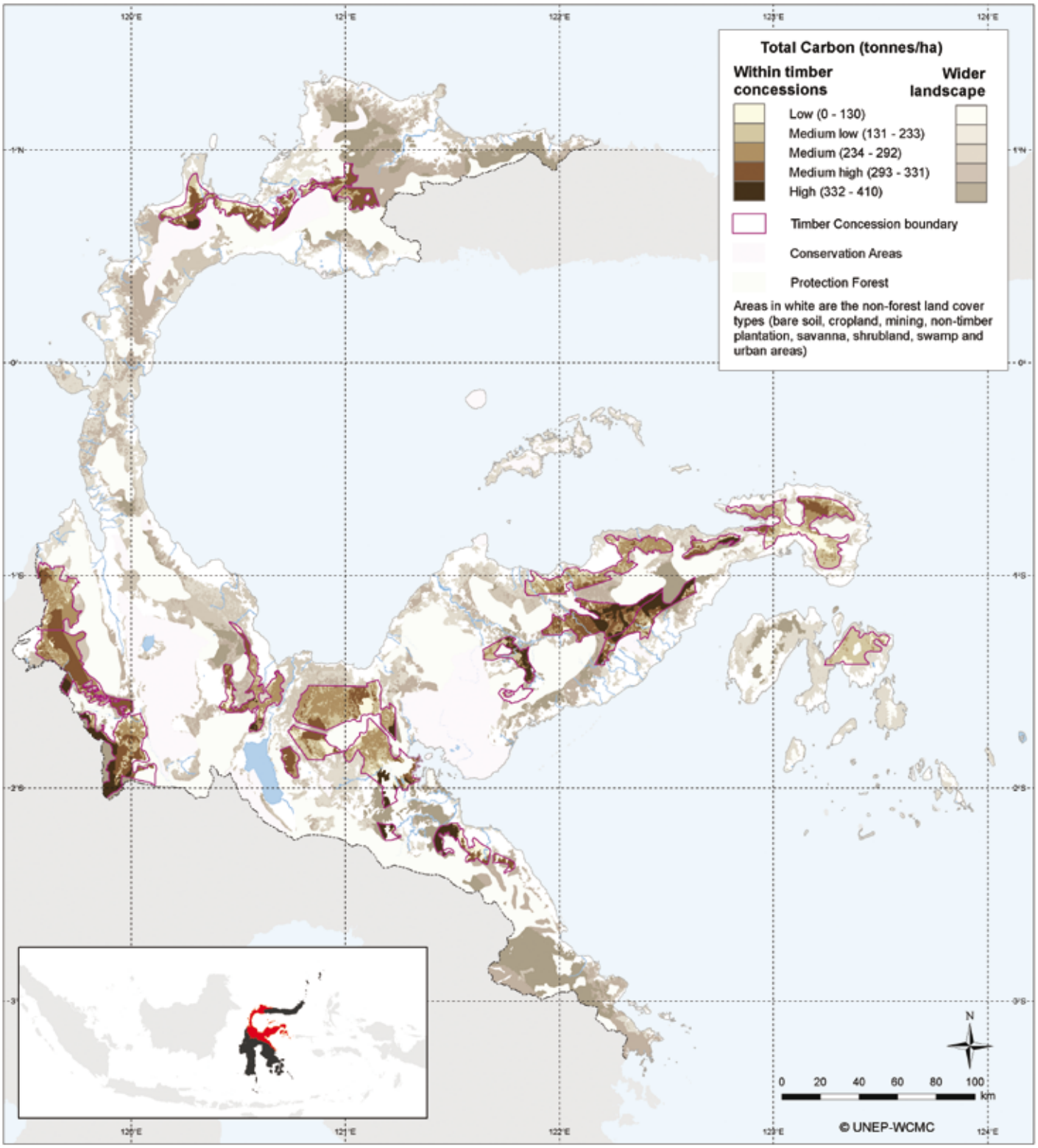
UN-REDD PROGRAMME

Process used to identify potential areas for REDD+ actions to manage forests sustainably



Central Sulawesi Province - Potential Areas for REDD+ Actions to Manage Forests Sustainably

This map shows total carbon stock in areas where timber extraction is currently permitted by law; existing concessions are highlighted



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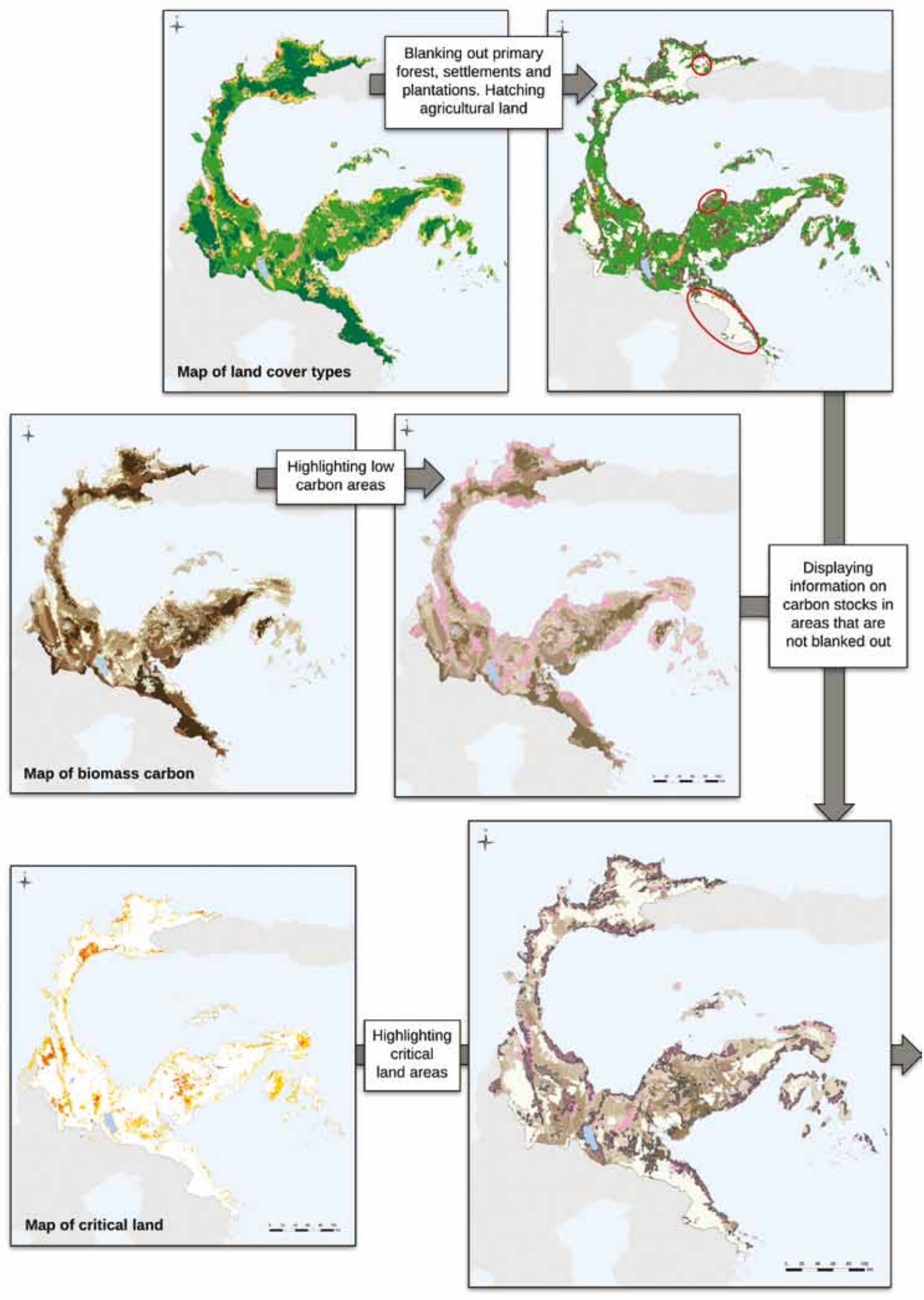
Method and Data Sources:
Biomass and Soil Carbon layers: see explanation on Map of Total Carbon for Central Sulawesi Province;
Method for presentation of potential areas for REDD+ actions to manage forests sustainably: Based on the land cover map for 2009 produced by the Ministry of Forestry and the Forest area map for Central Sulawesi based on Ministry of Forestry decree 757/KPTS-II/1999 (MoFor 1999), areas of production forest are shown in pale brown shading indicating their total carbon stock. Areas covered by existing concessions were highlighted based on data on timber extraction concessions from the Ministry of Forestry DG Forest Planning, DG Forest Planning Region XVI Palu, Regional Forest Service Central Sulawesi (2010). The following areas were blanked out: non-forest areas (shown in white on the map), conservation areas (shown in light purple) and protection forest (shown in light green). Conservation areas and protection forest shown as in Forest area map for Central Sulawesi based on Ministry of Forestry decree 757/KPTS-II/1999 (MoFor 1999), and updated with complementary GIS data on conservation areas received from Ministry of Forestry, Agency for the Conservation of Natural Resources Central Sulawesi.

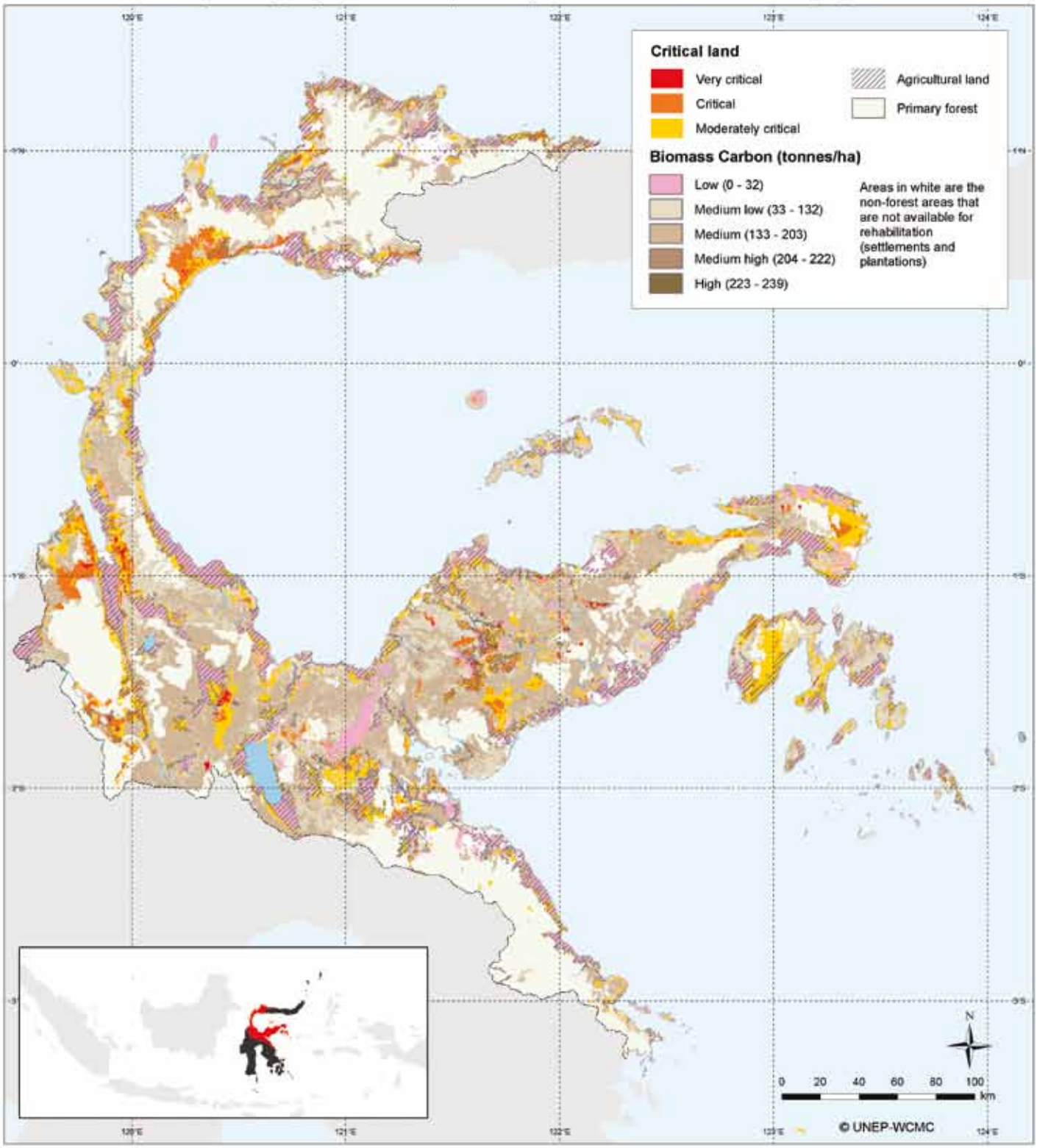
UN-REDD PROGRAMME

Process used to identify potential areas for REDD+ actions to rehabilitate forests



Central Sulawesi Province - Potential Areas for REDD+ Actions to Rehabilitate Forests

This map shows areas with potential for rehabilitation; "critical land" identified by Watershed Management Agency and areas with particularly low biomass carbon stocks are highlighted



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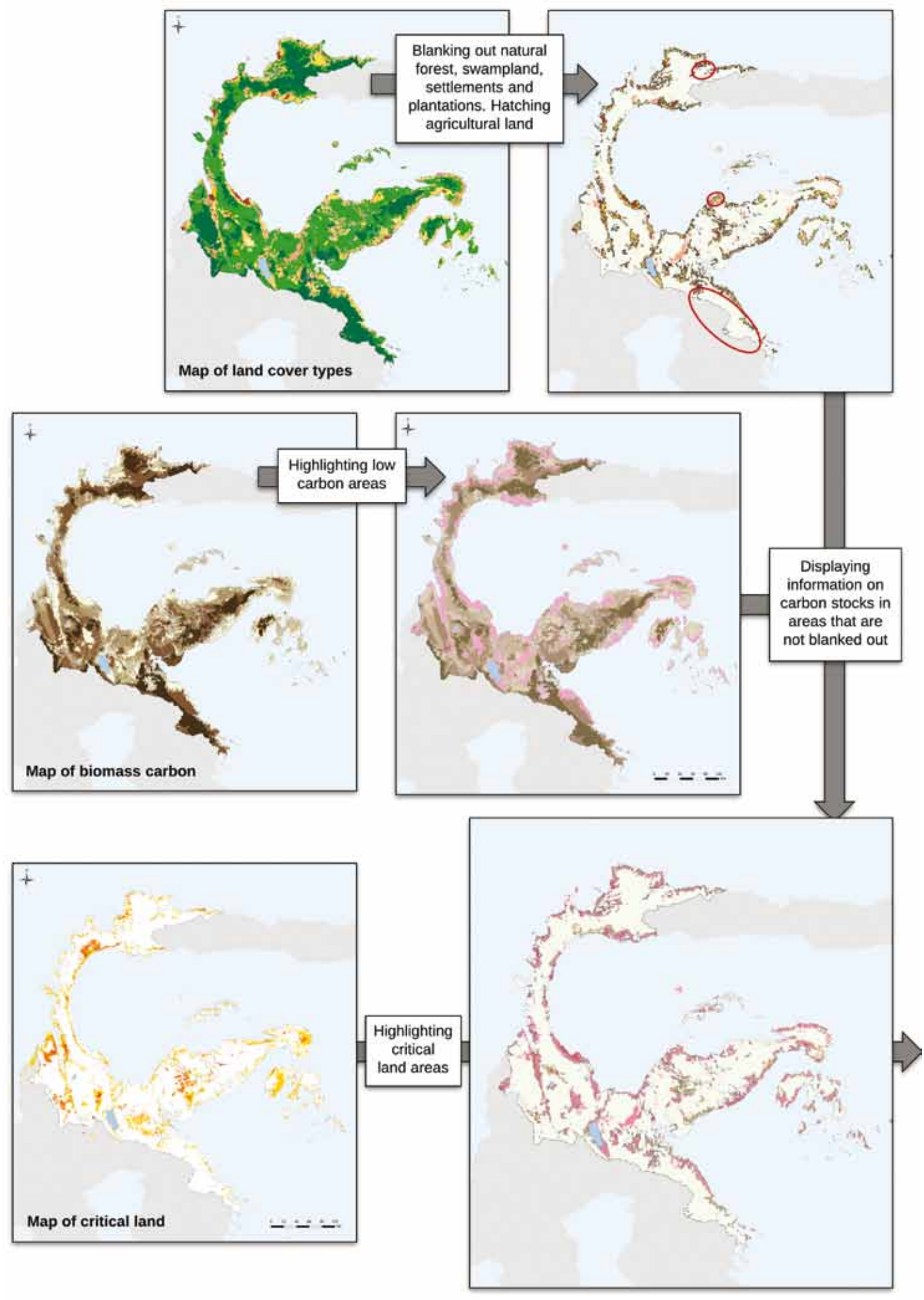
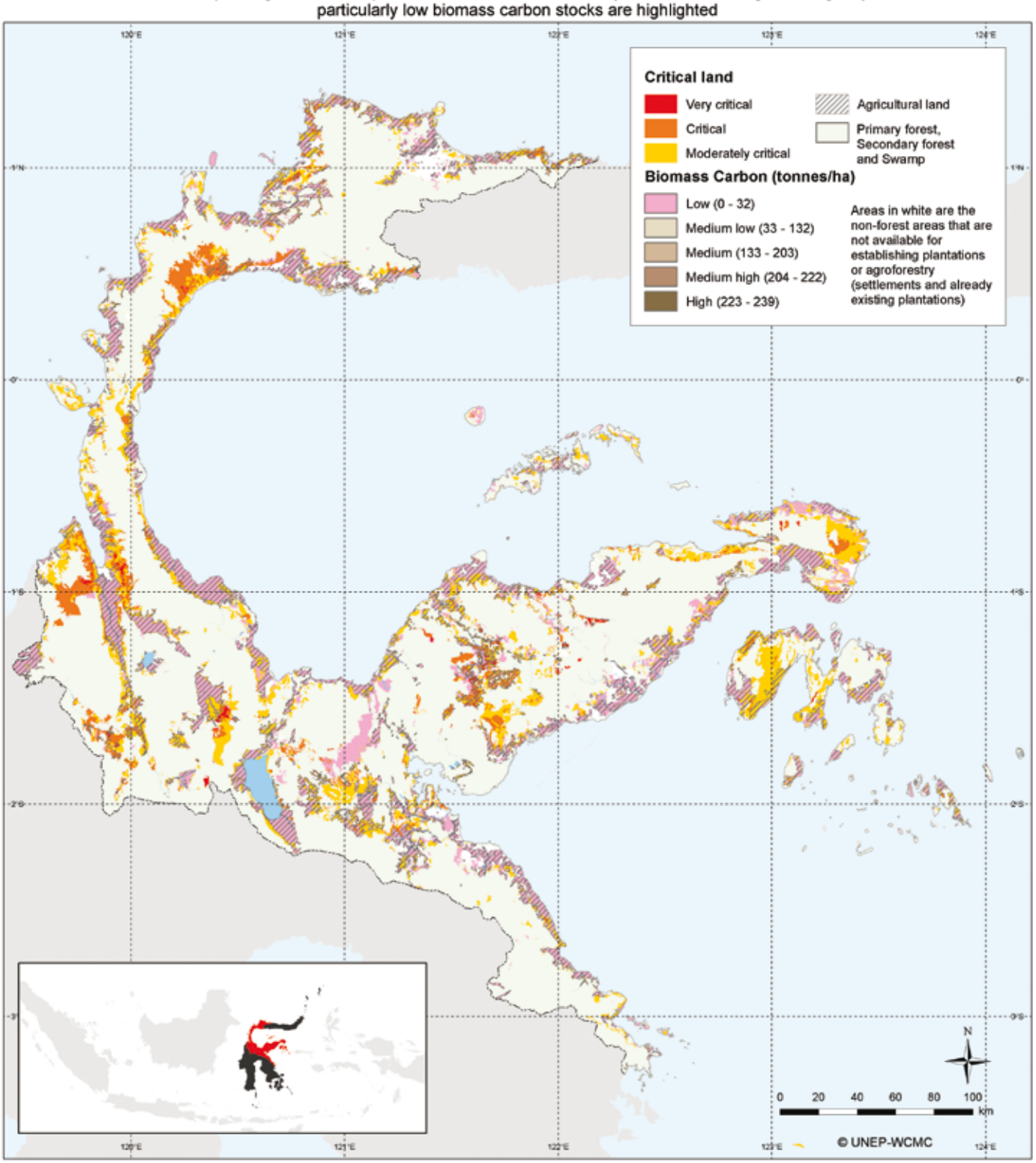
Method and Data Sources:
Biomass Carbon: see explanation on Map of Biomass Carbon for Central Sulawesi Province;
Method for presentation of potential areas for REDD+ actions to rehabilitate forests: Based on the land cover map for 2009 produced by the Ministry of Forestry, all areas that are considered to have potential and availability for rehabilitation are shown in brown shading indicating their biomass carbon stock. Low-carbon areas were highlighted in pink based on the Biomass Carbon layer. Areas identified as critical land were highlighted based on data from the Ministry of Forestry, Agency for Watershed Management Central Sulawesi. Agricultural areas (unlikely to be available for rehabilitation) were marked with black hatching and the following areas were blanked out: non-forest areas that are not available for rehabilitation (shown in white on the map) and primary forest (shown in light green).

Process used to identify potential areas for actions to establish plantations or agroforestry



Central Sulawesi Province - Potential Areas for Actions to Establish Plantations or Agroforestry

Under certain conditions, plantations and agroforestry can form part of a REDD+ strategy. This maps shows areas which could be available for planting timber or crop trees; "critical land" identified by Watershed Management Agency and areas with particularly low biomass carbon stocks are highlighted



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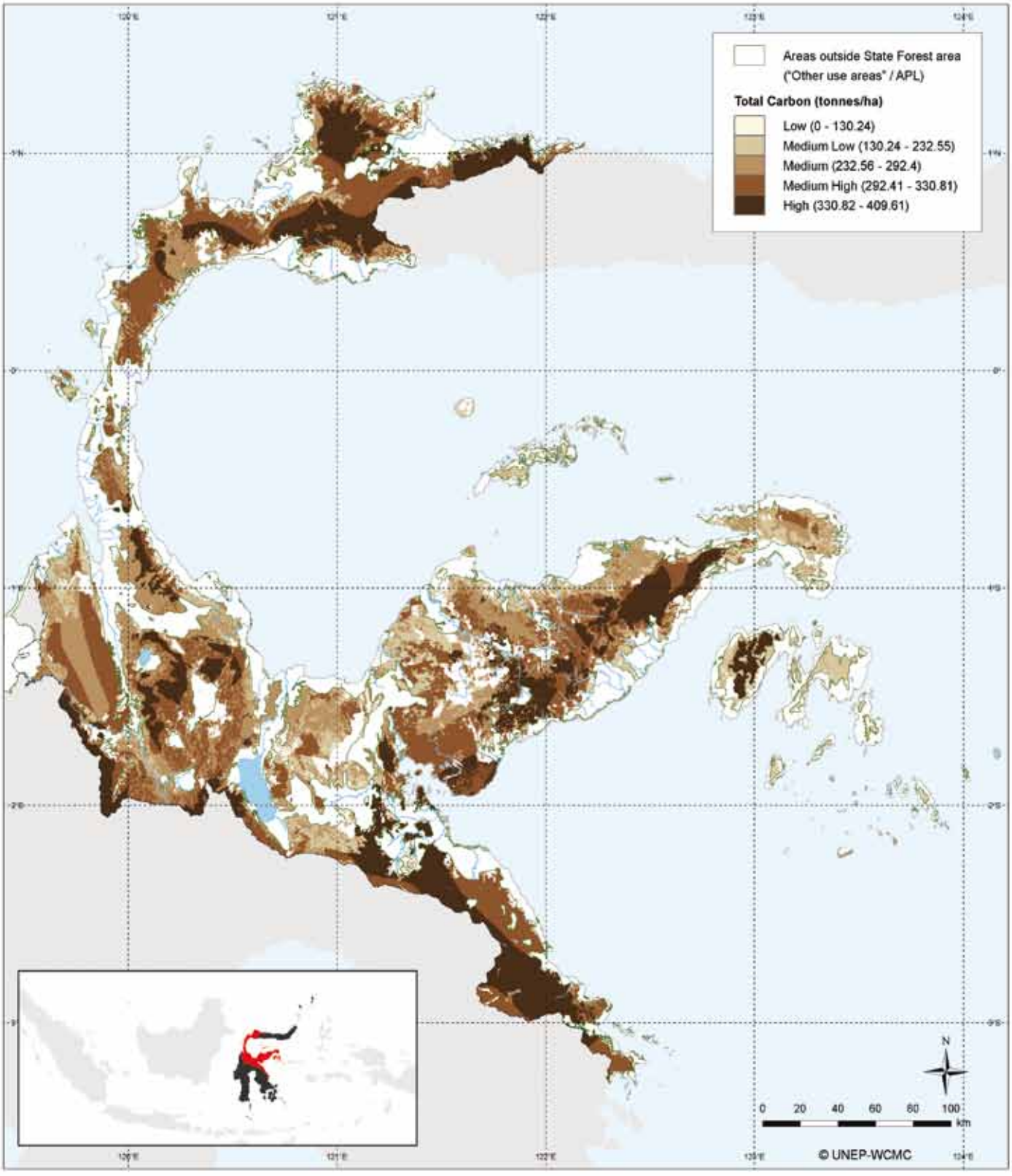
Method and Data Sources:
Biomass Carbon: see explanation on Map of Biomass Carbon for Central Sulawesi Province;
Method for presentation of potential areas for actions to establish plantations or agroforestry as part of a REDD+ strategy: Based on the land cover map for 2009 produced by the Ministry of Forestry, all areas that are considered to have potential and availability for the establishment of plantations or agroforestry are shown in brown shading indicating their biomass carbon stock. Low-carbon areas were highlighted in pink based on the Biomass Carbon layer. Areas identified as critical land were highlighted based on data from the Ministry of Forestry, Agency for Watershed Management Central Sulawesi. Agricultural areas (unlikely to be available for the establishment of plantations but possibly partly available for expanding agroforestry) were marked with black hatching and the following areas were blanked out: non-forest areas that are not available for establishing plantations or agroforestry (shown in white on the map) and areas of existing forest and swamp (shown in light green). Areas shown as existing forest on the land cover map are unlikely to become eligible for plantations or agroforestry under REDD+ due to safeguards against conversion of natural forest. Conversion of swamp areas to plantations and agroforestry is likely to cause net carbon emissions and thus be counterproductive to the aims of REDD+. Maps should be checked against situation on the ground.

Central Sulawesi – Total carbon within the State Forest area

Regardless of actual land cover, land use within the designated state forest area comes under the authority of the Ministry of Forestry



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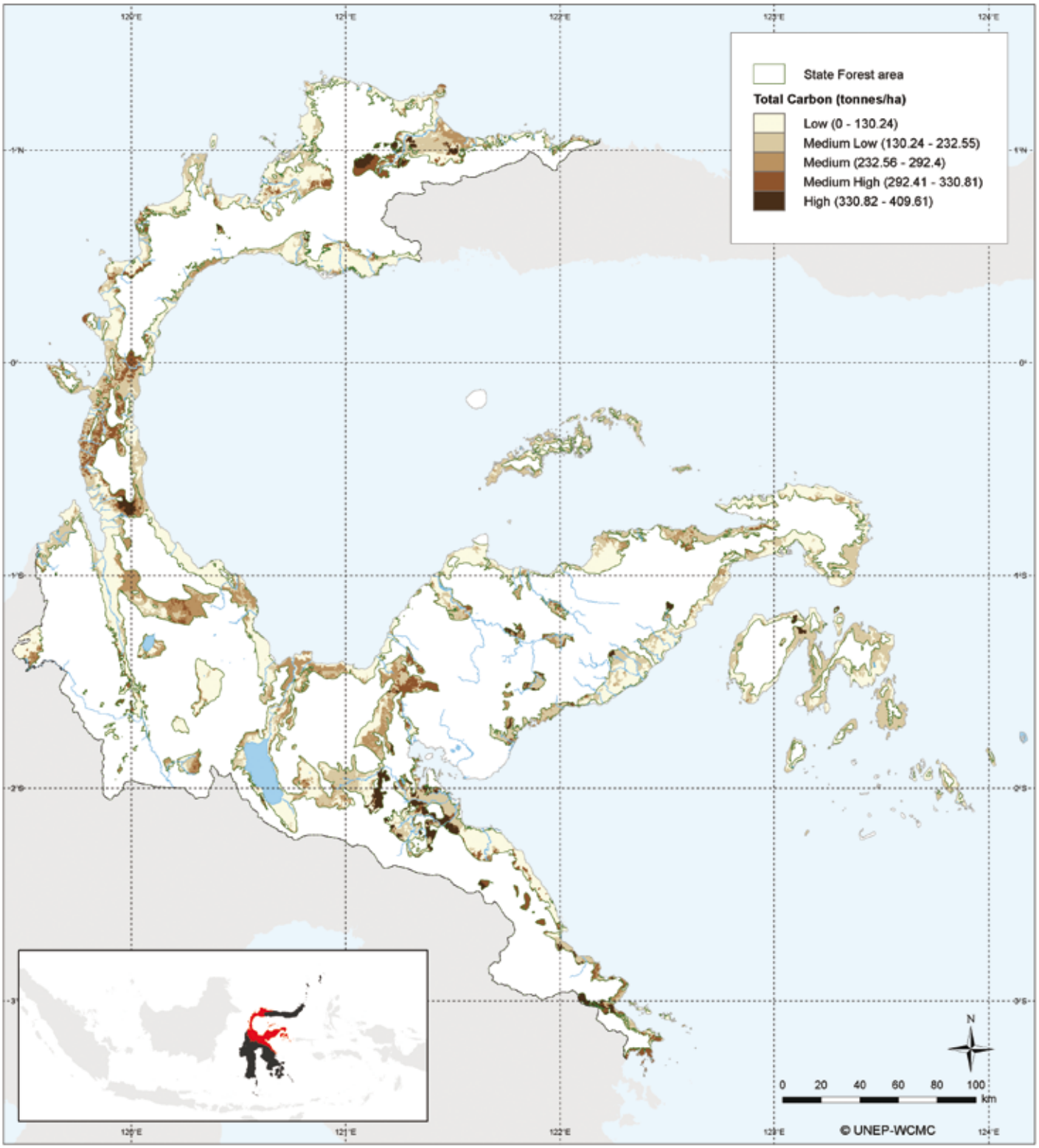
Method and Data Sources:
Biomass and Soil Carbon layers: see explanation on Map of Total Carbon for Central Sulawesi Province;
Method for the presentation of carbon within the State Forest area: Based on data showing the boundary of the state forest area, obtained from the Ministry of Forestry, Agency for Watershed Management Central Sulawesi, all areas inside the State Forest area are shown in brown shading indicating their total carbon stock. Areas outside of the State Forest area were blanked out (shown in white on the map).

UN-REDD PROGRAMME

Central Sulawesi – Total carbon outside of the State Forest area

Substantial carbon stocks exist outside of the State Forest area. Although they are not administered under the Ministry of Forestry, forests outside the State Forest area can play an important role in REDD+ strategies.



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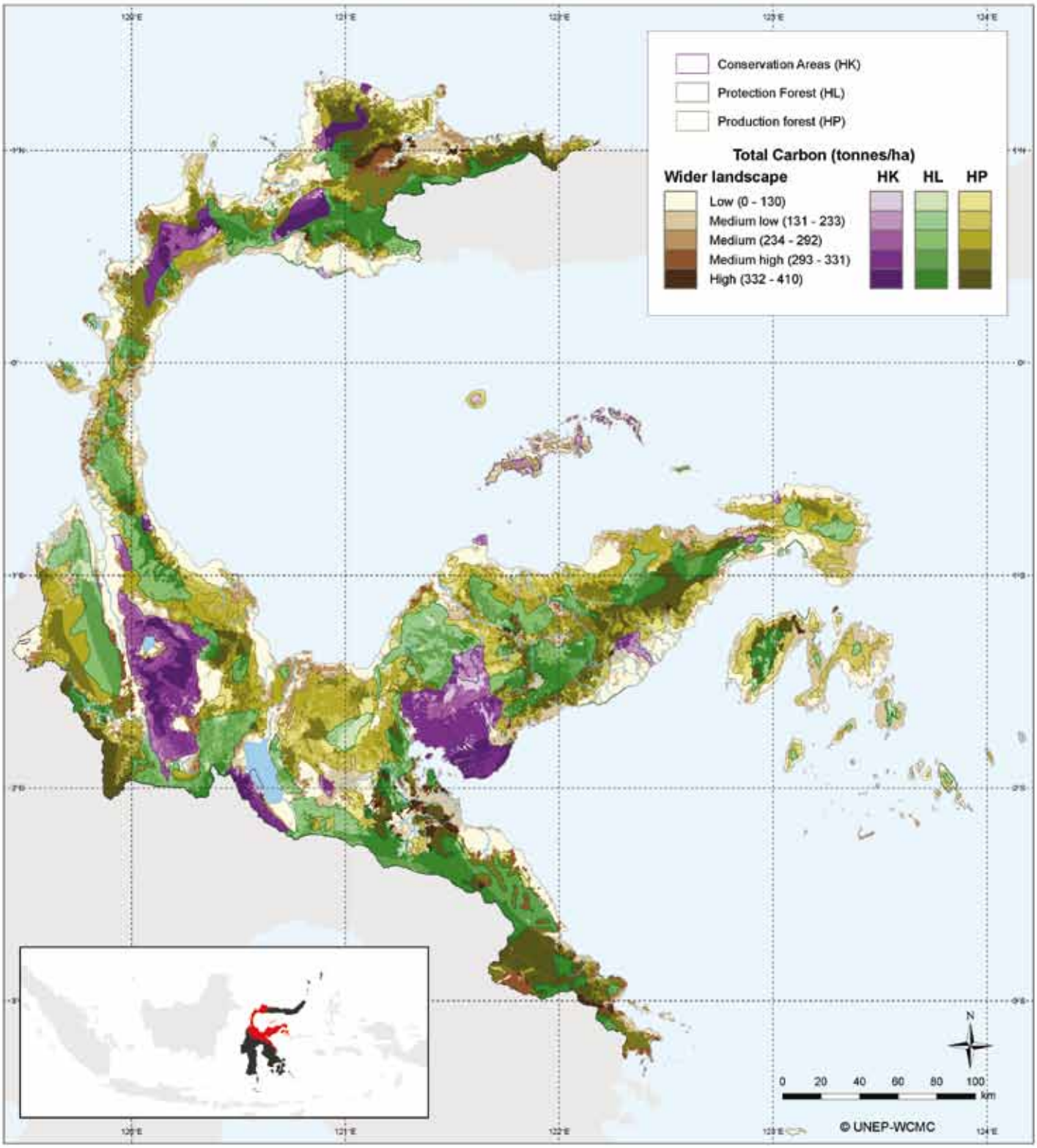
Method and Data Sources:
Biomass and Soil Carbon layers: see explanation on Map of Total Carbon for Central Sulawesi Province;
Method for the presentation of carbon outside of the State Forest area Based on data showing the boundary of the state forest area, obtained from the Ministry of Forestry, Agency for Watershed Management Central Sulawesi, all areas outside of the State Forest area ("Other Use areas"/APL) are shown in brown shading indicating their total carbon stock. Areas inside of the State Forest area were blanked out (shown in white on the map).

UN-REDD PROGRAMME

Central Sulawesi – Designated Forest Functions in relation to Total Carbon

The designation of forest functions as laid out in Ministry of Forestry decree 757/KPTS-II/1999 determines which management activities can be permitted in the different forest areas. It can also give a first indication of the value of these areas for maintaining biodiversity and ecosystem services.



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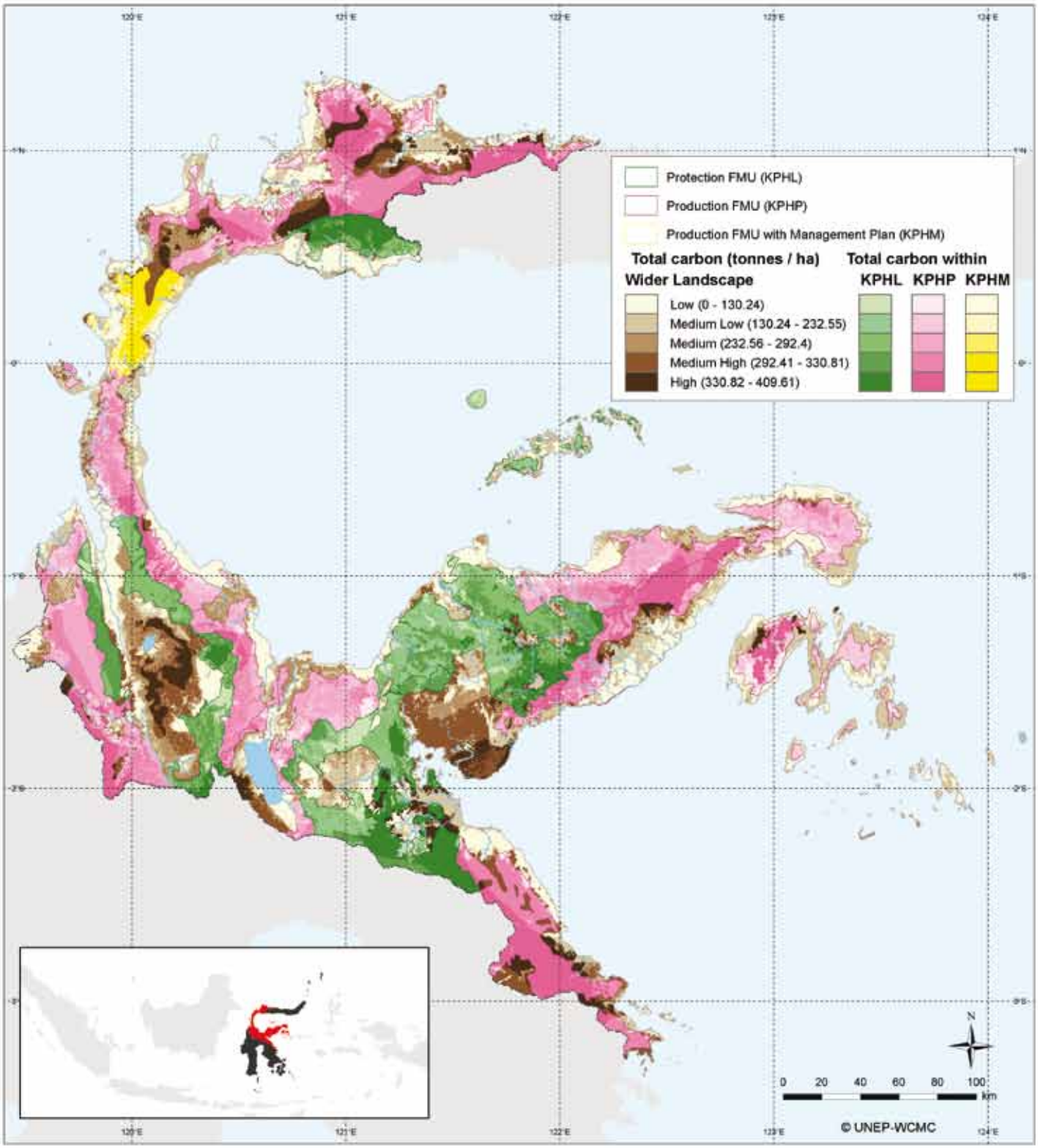
Method and Data Sources:
Biomass and Soil Carbon layers: see explanation on Map of Total Carbon for Central Sulawesi Province.
Location of production forest, protection forest and conservation areas: Forest area map for Central Sulawesi based on Ministry of Forestry decree 757/KPTS-II/1999 (MoFor 1999) and complementary GIS data on conservation areas received from Ministry of Forestry, Agency for the Conservation of Natural Resources Central Sulawesi.

Central Sulawesi – Forest Management Units in relation to Total Carbon

Establishment and strengthening of Forest Management Units are important steps towards improved forest governance and can help to implement REDD+



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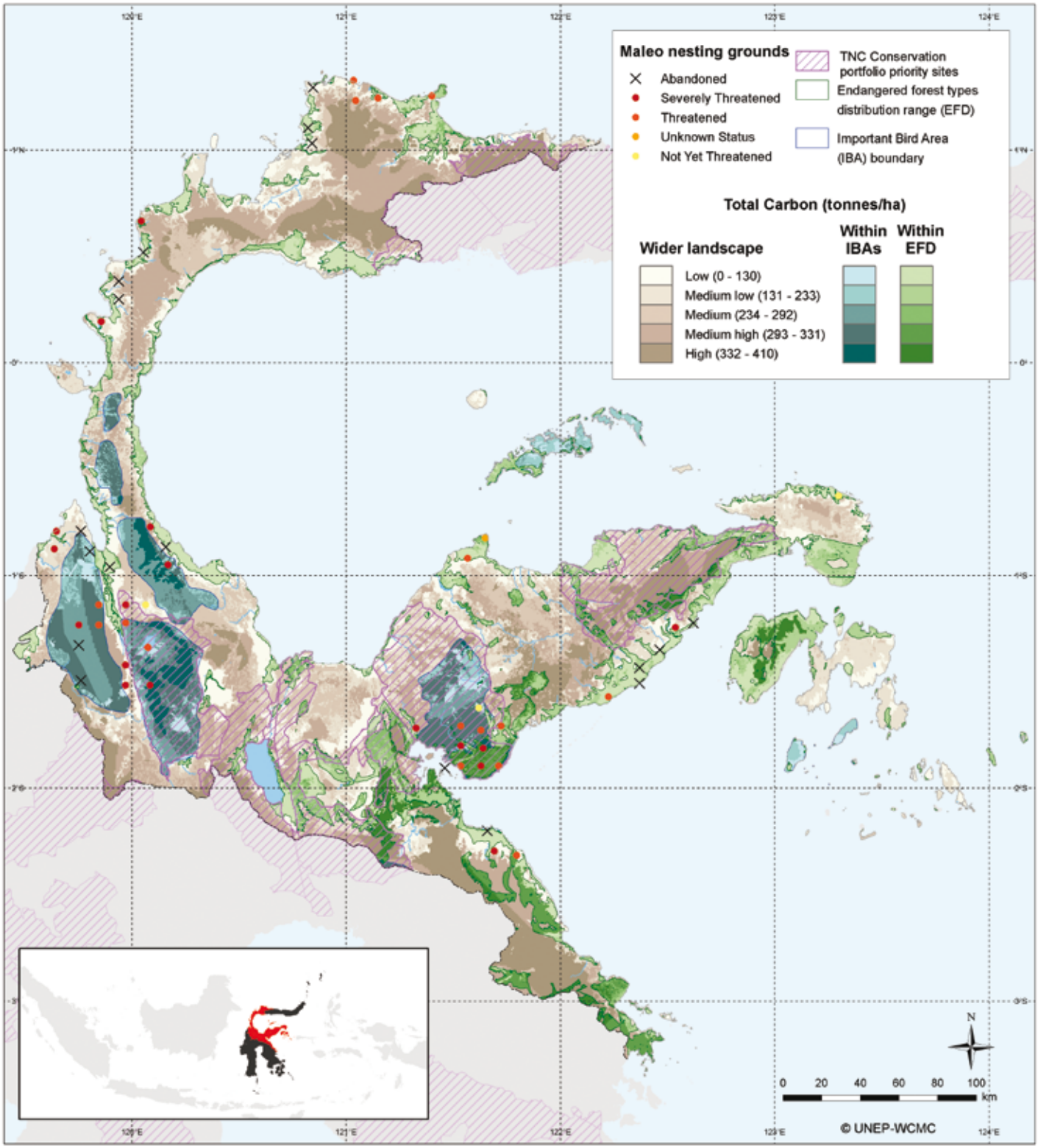
Method and Data Sources:
Biomass and Soil Carbon layers: see explanation on Map of Total Carbon for Central Sulawesi Province.
Forest Management Units: Data on Forest Management Units obtained from Ministry of Forestry DG Forest Planning, DG Forest Planning Region XVI Palu, Regional Forest Service Central Sulawesi

UN-REDD PROGRAMME

Central Sulawesi Province - Important Areas for Biodiversity in relation to Total Carbon

Biodiversity benefits from REDD+ can be enhanced if efforts to maintain
(or restore) natural forest focus on areas important for biodiversity



This map was produced for the UN-REDD programme in Indonesia in collaboration between UNEP-WCMC and the Ministry of Forestry of Indonesia, DG Forest Planning (Jakarta Office and Office for Forest Planning Region XVI), the Regional Forest Service Central Sulawesi and Tadulako University.

The boundaries and names shown and the designations used on maps do not imply official endorsement or acceptance by the United Nations Environment Programme or contributory Organisations.

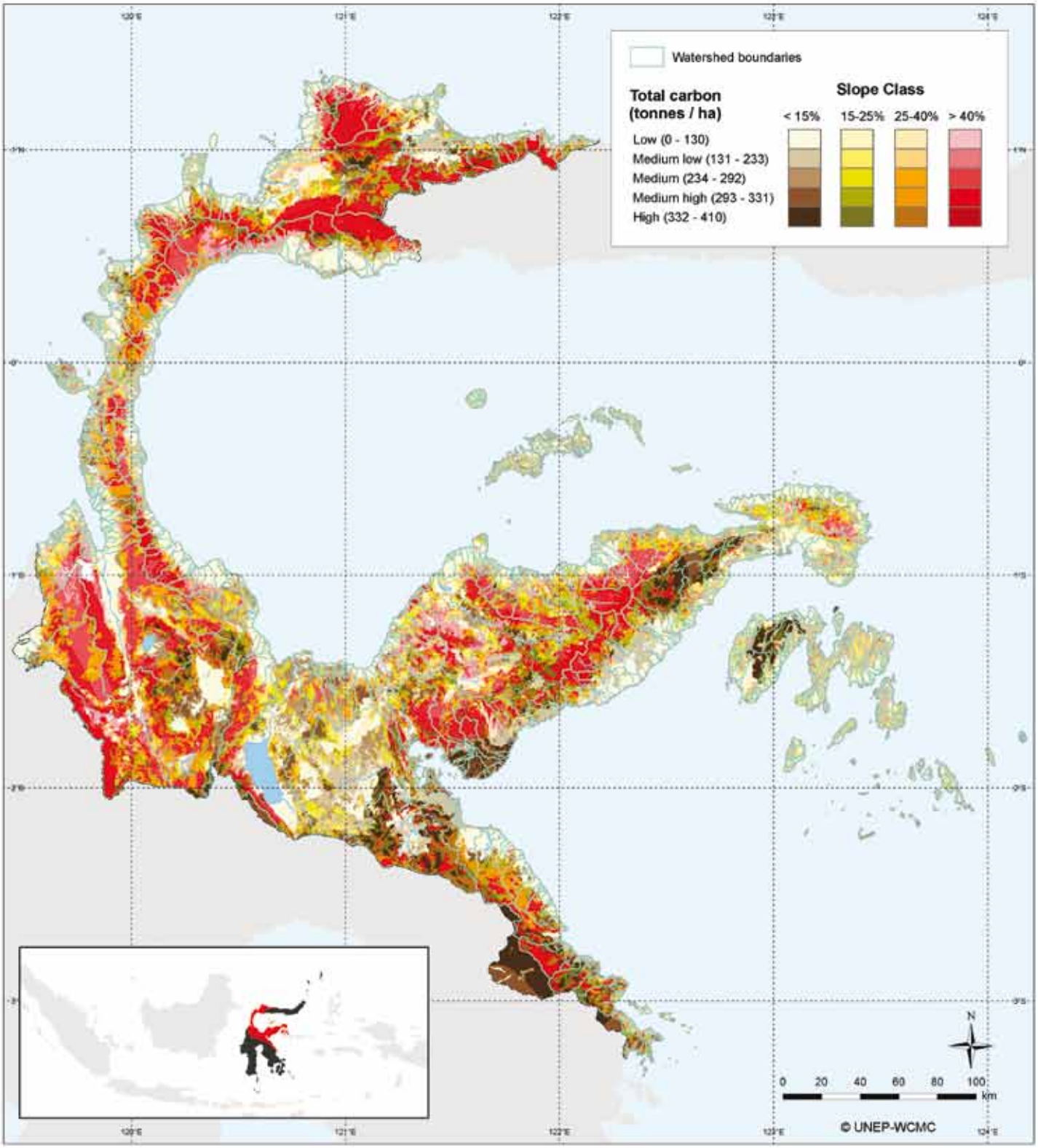
Method and Data Sources:
Biomass and Soil Carbon layers: see explanation on Map of Total Carbon for Central Sulawesi Province;
Important Bird Areas (IBAs): Birdlife International (2010): Important bird areas (GIS data). Birdlife International, Cambridge, UK. Accessed 27-05-2011.
Maleo Nesting Sites: GIS data on maleo (*Macrocephalon maleo*) nesting sites obtained from TNC Indonesia.
Endangered Forest Types Distribution Range (EFD): GIS data on distribution of forest types obtained from TNC Indonesia (see: Cannon, C. H., Summers, M., Harting, J. R., Kessler, P. J. A. (2007): Developing Conservation Priorities Based on Forest Type, Condition, and Threats in a Poorly Known Ecoregion: Sulawesi, Indonesia. Biotropica 39(6): 747-759 2007.)
Conservation portfolio priority sites: GIS data on conservation portfolio priority sites obtained from TNC Indonesia (see: Cannon, C. H., Summers, M., Harting, J. R., Kessler, P. J. A. (2007): Developing Conservation Priorities Based on Forest Type, Condition, and Threats in a Poorly Known Ecoregion: Sulawesi, Indonesia. Biotropica 39(6): 747-759 2007.)

UN-REDD PROGRAMME

The Nature Conservancy
Protecting nature. Preserving life.™

Central Sulawesi – Factors relevant to Erosion Control in relation to Total Carbon

This map shows total carbon stock in relation to slope class and watershed boundaries; the benefits for erosion control that can be achieved by maintaining or restoring forest are greatest on steep slopes or in watersheds where sensitive infrastructure is located



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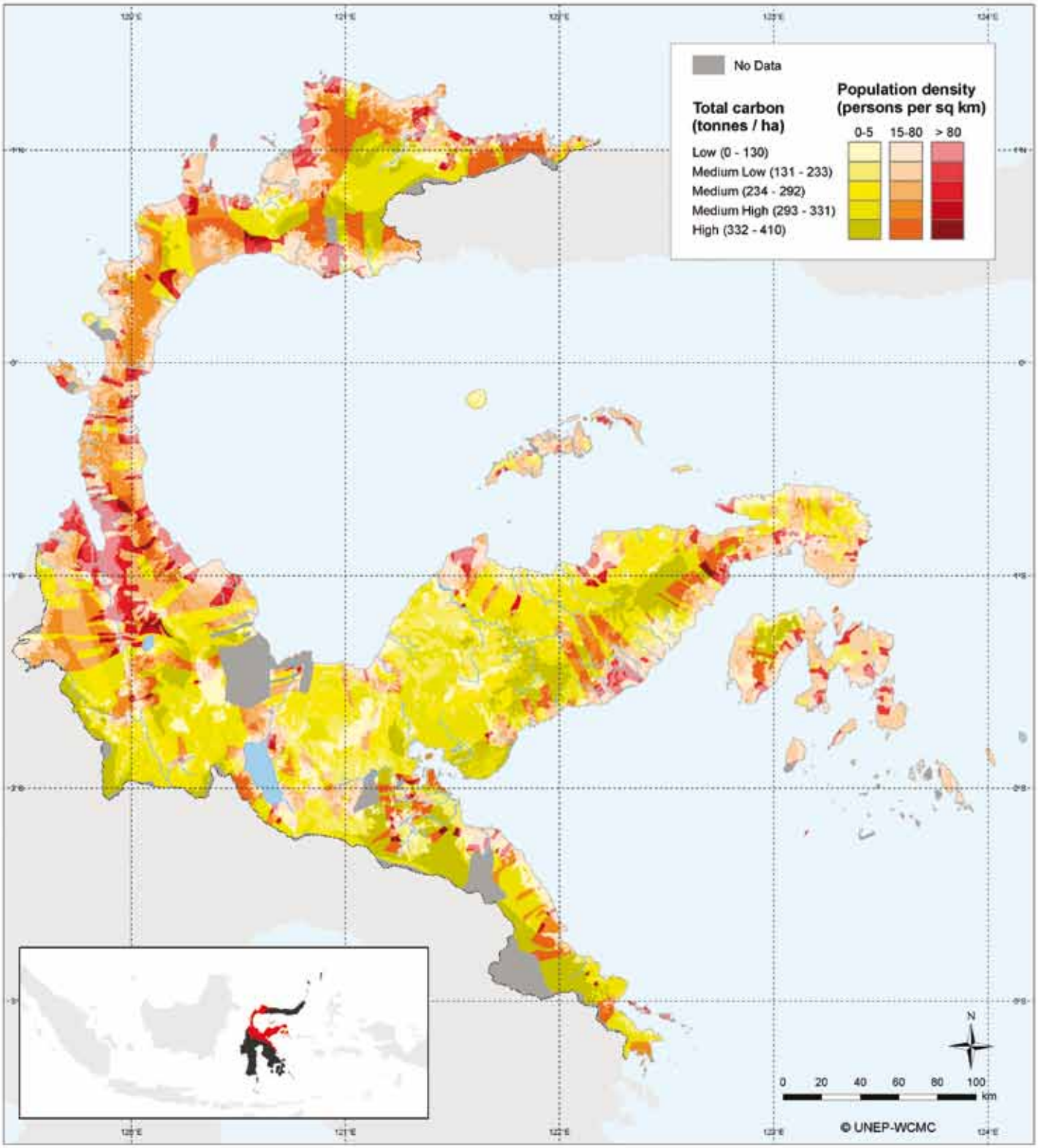
Method and Data Sources:
Biomass and Soil Carbon layers: see explanation on Map of Total Carbon for Central Sulawesi Province.
Watershed Boundaries and Slope Classes: Data obtained from the Ministry of Forestry, Agency for Watershed Management Central Sulawesi.

UN-REDD PROGRAMME

Central Sulawesi – Population Density per Village Territory in relation to Total Carbon

Actors designing REDD+ strategies need to pay attention to possible impacts on the wellbeing of local populations and take their needs and aspirations into account. This may be more demanding in areas of high population density



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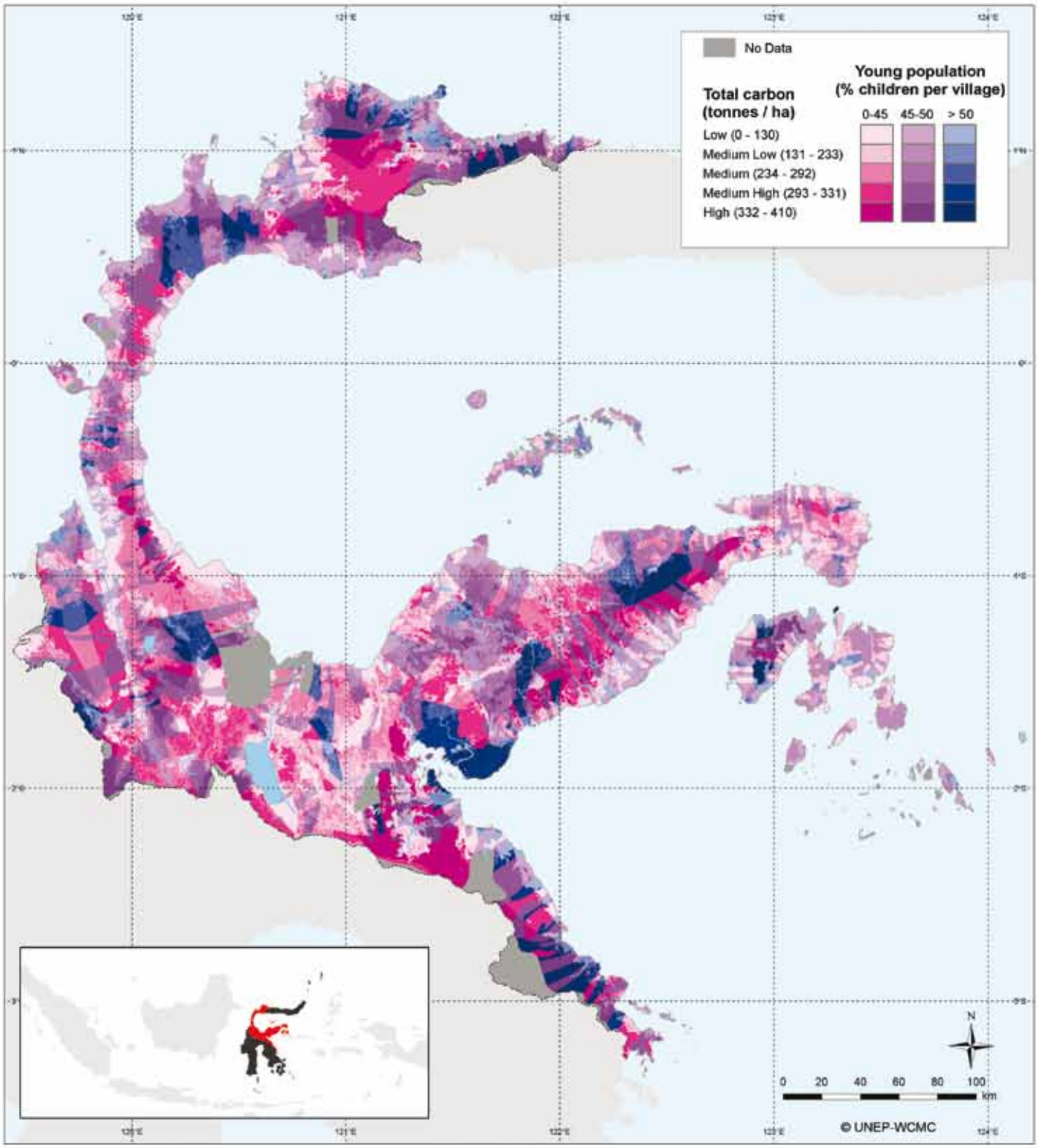
Method and Data Sources:
Biomass and Soil Carbon layers: see explanation on Map of Total Carbon for Central Sulawesi Province.
Population Density: Data on population numbers per village obtained from Ministry of Forestry DG Forest Planning, DG Forest Planning Region XVI Palu, Regional Forest Service Central Sulawesi.

UN-REDD PROGRAMME

Central Sulawesi – Children as a Percentage of the Population in relation to Total Carbon

The proportion of young people in the population can be an indicator of population trends. REDD+ strategies for areas with high population growth rates may need to pay particular attention to the development of sustainable livelihood opportunities



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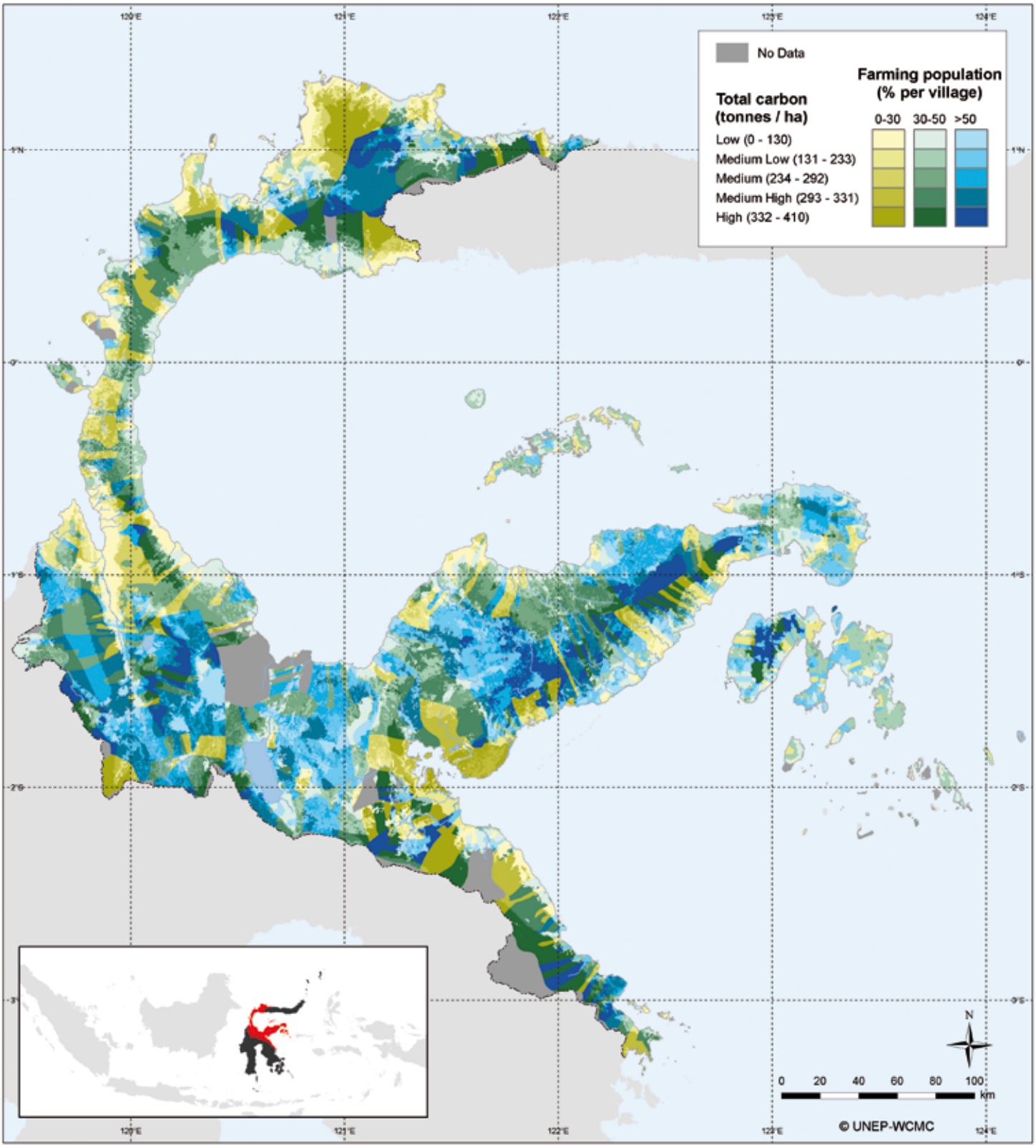
Method and Data Sources:
Biomass and Soil Carbon layers: see explanation on Map of Total Carbon for Central Sulawesi Province.
Percentage of children in the population: Data on total population and number of children per village obtained from Ministry of Forestry DG Forest Planning, DG Forest Planning Region XVI Palu, Regional Forest Service Central Sulawesi.

UN-REDD PROGRAMME

Central Sulawesi – Percentage of the Population engaged in Farming in relation to Total Carbon

Agriculture is one of the main drivers of deforestation. REDD+ strategies for areas where a high percentage of the population is engaged in farming may need to place a special focus on actions that reduce conversion pressure without endangering local livelihoods



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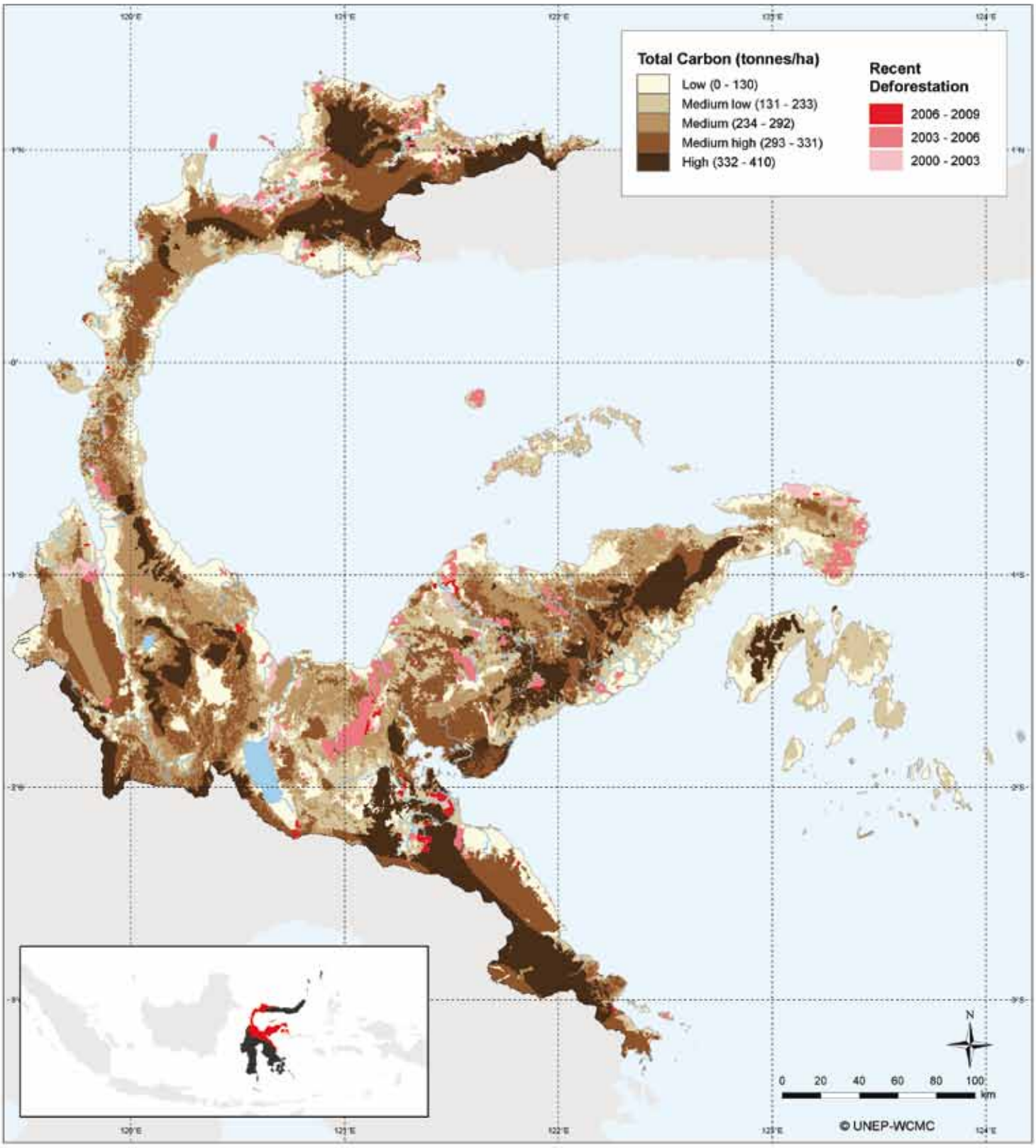
Method and Data Sources:
Biomass and Soil Carbon layers: see explanation on Map of Total Carbon for Central Sulawesi Province.
Percentage of farmers in the population: Data on total population and number of farmers per village obtained from Ministry of Forestry DG Forest Planning, DG Forest Planning Region XVI Palu, Regional Forest Service Central Sulawesi.

UN-REDD PROGRAMME

Central Sulawesi – Areas of Recent Deforestation in relation to Total Carbon

Depending on local conditions, carbon in forest areas close to recent deforestation may be at high risk of being lost.



This map was produced for the UN-REDD programme in Indonesia in collaboration between UNEP-WCMC and the Ministry of Forestry of Indonesia, DG Forest Planning (Jakarta Office and Office for Forest Planning Region XVI), the Regional Forest Service Central Sulawesi and Tadulako University.

Method and Data Sources:
Biomass and Soil Carbon layers: see explanation on Map of Total Carbon for Central Sulawesi Province.
Areas of Recent Deforestation: Based on the land cover maps for 2003, 2006 and 2009 produced by the Ministry of Forestry, recently deforested areas were identified.

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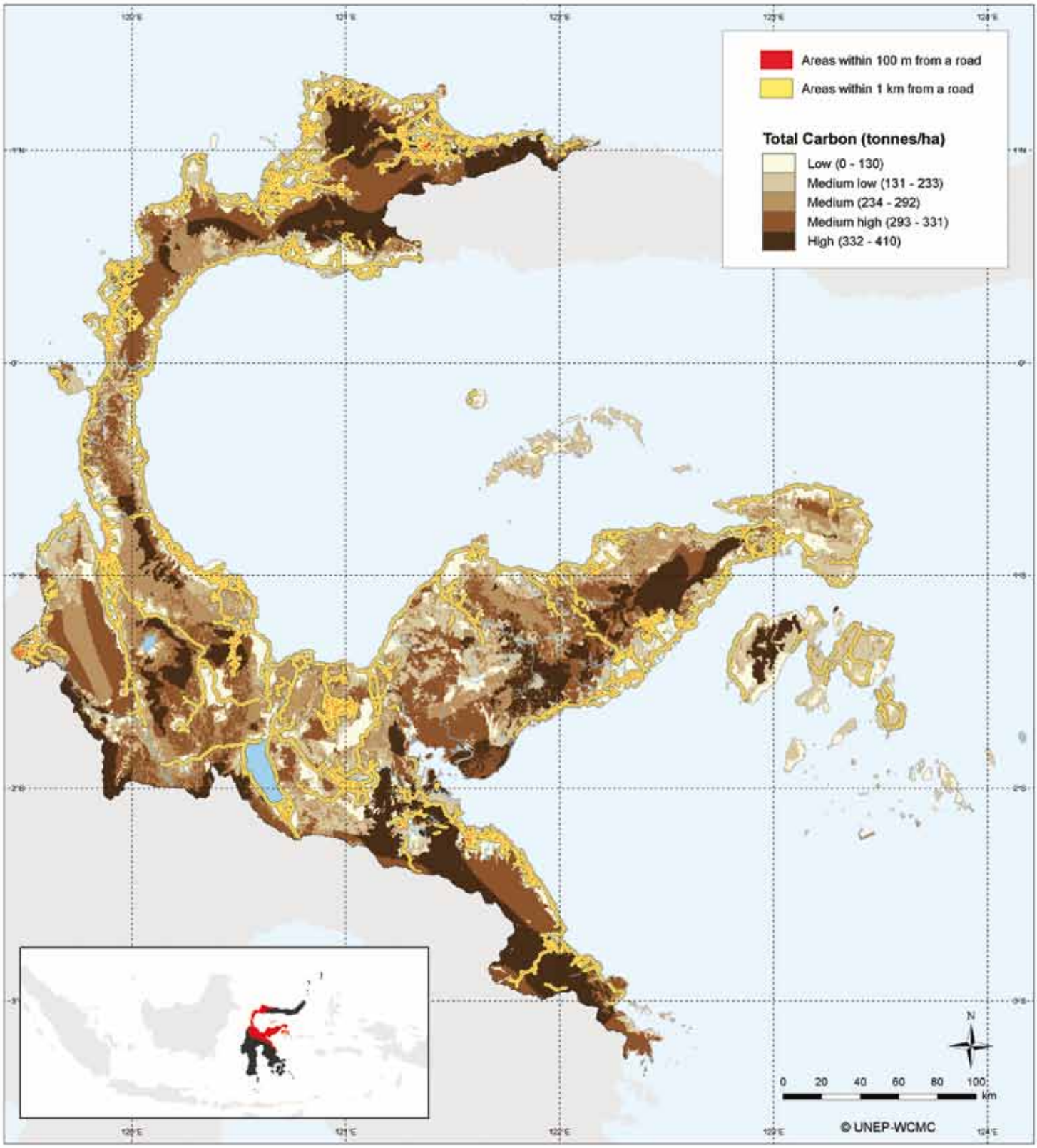
Central Sulawesi – Areas adjacent to Roads in relation to Total Carbon

Carbon in forest areas that are close to a road is often more vulnerable to anthropogenic pressure. It is therefore useful for REDD+ planning to pay attention to high carbon areas adjacent to roads, to assess the risk of deforestation and forest degradation and whether it can be addressed.



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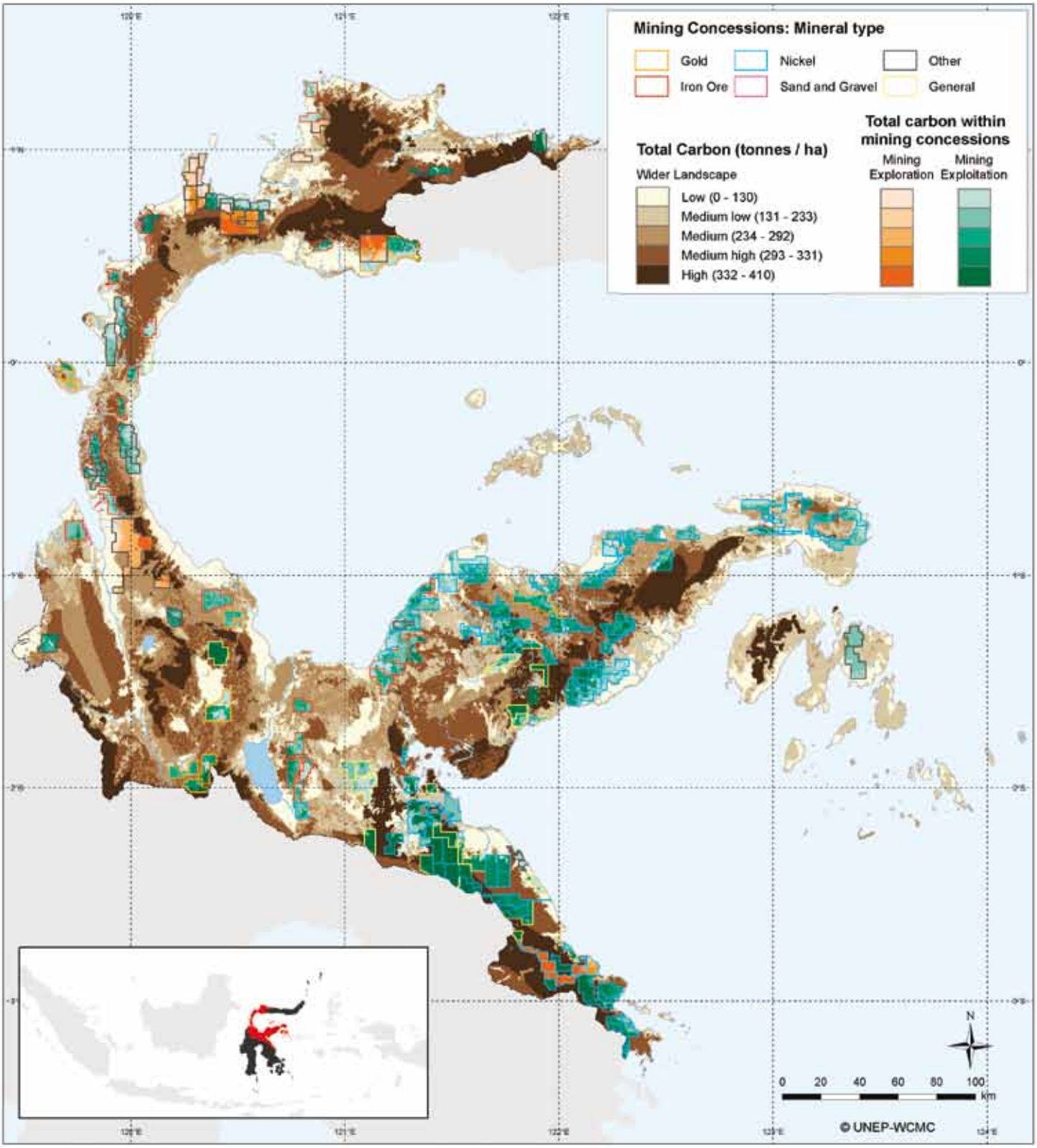
The boundaries and names shown and the designations used on maps do not imply official endorsement or acceptance by the United Nations Environment Programme or contributory Organisations.

Method and Data Sources:
Biomass and Soil Carbon layers: see explanation on Map of Total Carbon for Central Sulawesi Province;
Areas adjacent to Roads: Based on GIS data on the road network in Central Sulawesi obtained from Ministry of Forestry DG Forest Planning, areas located within a distance of 100 m and 1 km from roads were marked.

Central Sulawesi – Mining Concessions in relation to Total Carbon

Where mining concessions coincide with areas of high carbon density, trade-offs between REDD+ and mining interests may need to be managed



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Method and Data Sources:
Methods: Biomass and Soil Carbon layers: see explanation on Map of Total Carbon for Central Sulawesi Province.
Mining concessions: Data obtained from Ministry of Forestry DG Forest Planning, DG Forest Planning Region XVI Palu, Regional Forest Service Central Sulawesi.

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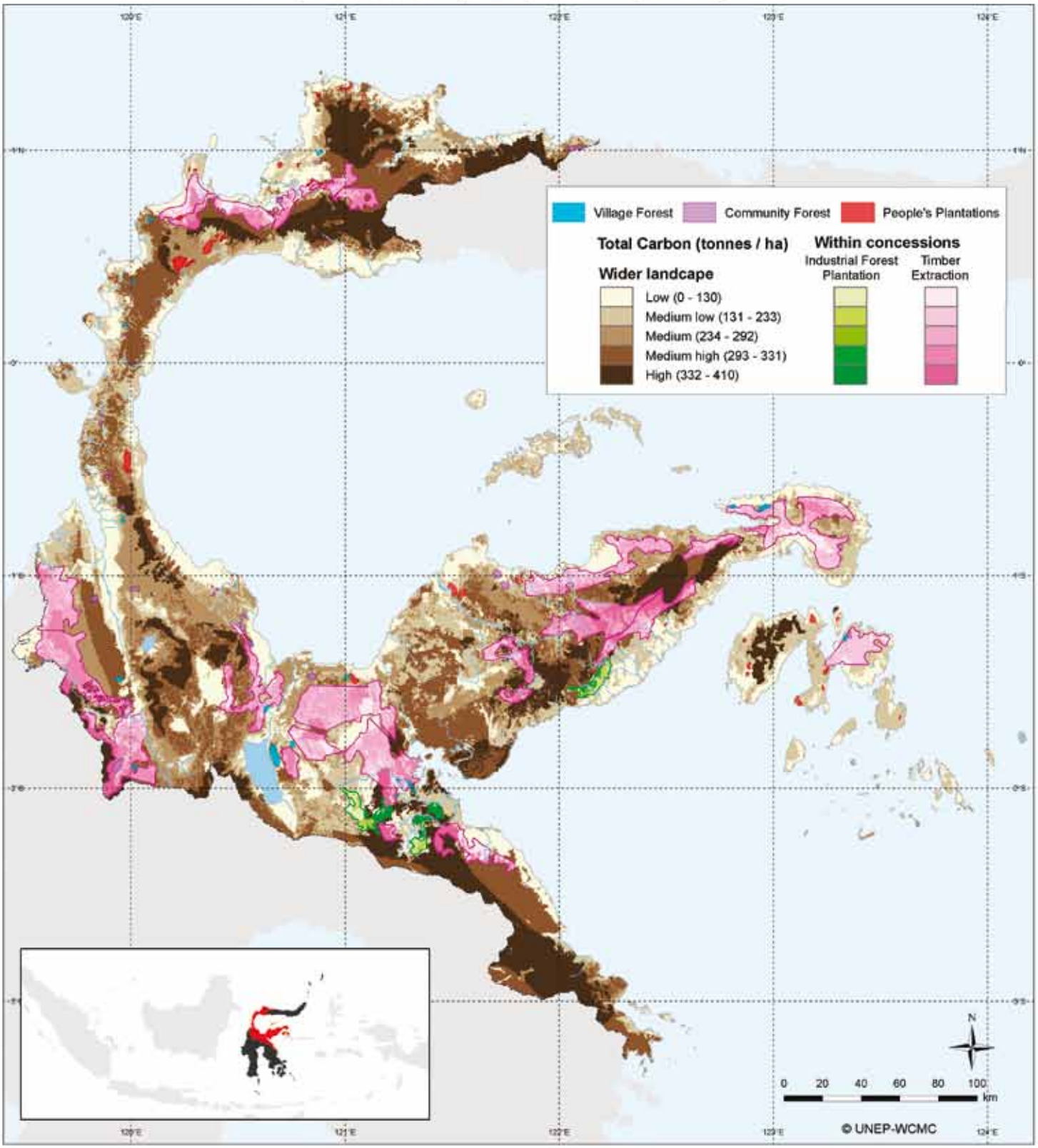
Central Sulawesi – Concessions for Utilization of Natural Forest and Forest Plantations in relation to Total Carbon

All holders of rights to use timber and non-timber forest products or to establish timber plantations can be important partners in implementing REDD+

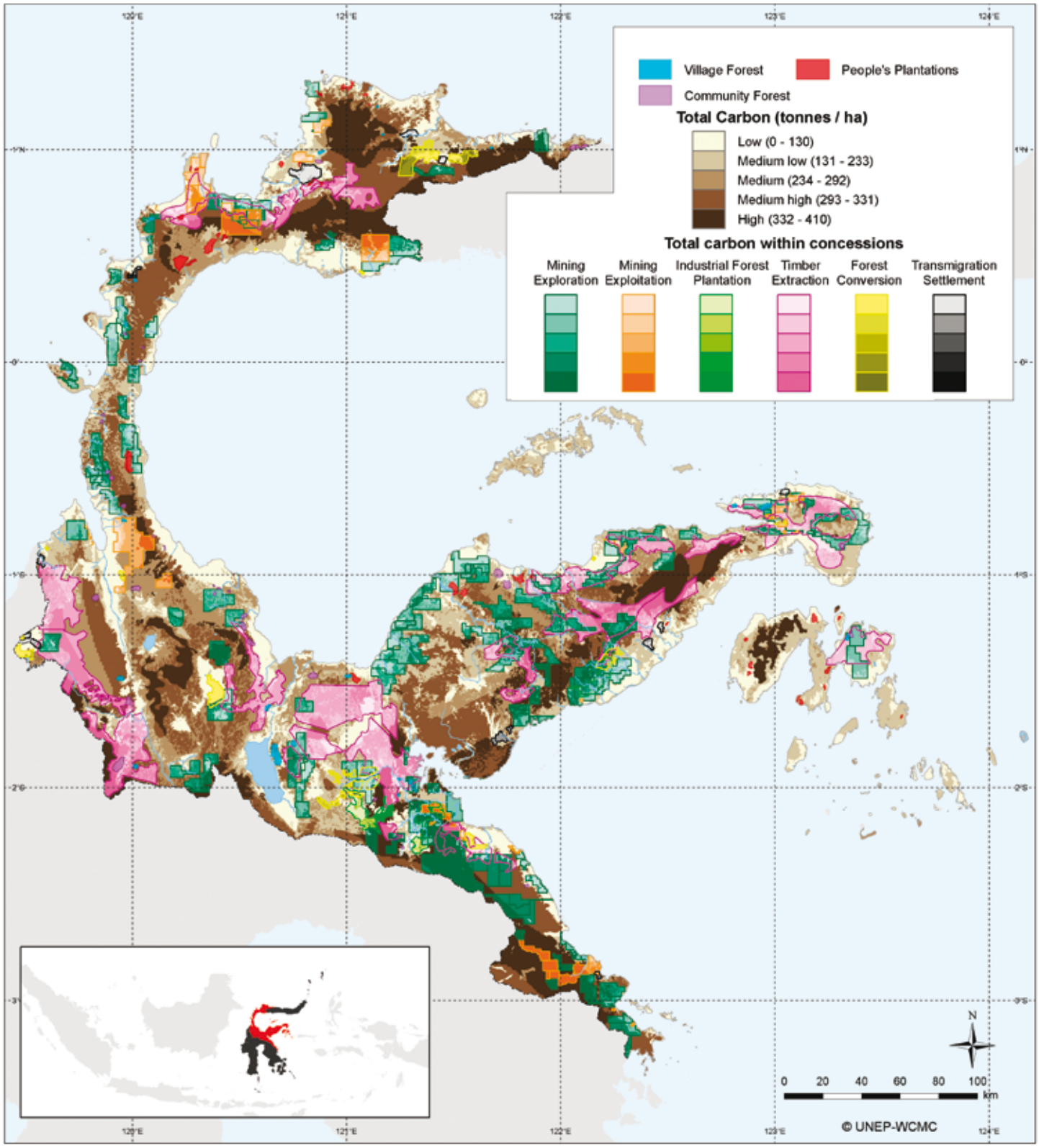


This map was produced for the UN-REDD programme in Indonesia in collaboration between UNEP-WCMC and the Ministry of Forestry of Indonesia, DG Forest Planning (Jakarta Office and Office for Forest Planning Region XVI), the Regional Forest Service Central Sulawesi and Tadulako University.

Method and Data Sources:
Biomass and Soil Carbon layers: see explanation on Map of Total Carbon for Central Sulawesi Province.
Timber Extraction concessions and concessions for Industrial Forest Plantations: Data obtained from Ministry of Forestry DG Forest Planning.
Village Forests, Community Forests and People's Plantations: Data obtained from the Ministry of Forestry, Agency for Watershed Management Central Sulawesi.

Central Sulawesi – Concessions and Community Involvement in Forest Use in relation to Total Carbon

Plans for REDD+ implementation need to take account of all currently existing rights to the use of forest land



This map was produced for the UN-REDD programme in Indonesia in collaboration between UNEP-WCMC and the Ministry of Forestry of Indonesia, DG Forest Planning (Jakarta Office and Office for Forest Planning Region XVI), the Regional Forest Service Central Sulawesi and Tadulako University.

Method and Data Sources:
Biomass and Soil Carbon layers: see explanation on Map of Total Carbon for Central Sulawesi Province.
Timber extraction concessions and concessions for Industrial Forest Plantations: Data obtained from Ministry of Forestry DG Forest Planning.
Concessions for Transmigration settlements, non-timber Plantations and Mining: Data obtained from Ministry of Forestry DG Forest Planning, DG Forest Planning Region XVI Palu, Regional Forest Service Central Sulawesi.
Village Forests, Community Forests and People's Plantations: Data obtained from the Ministry of Forestry, Agency for Watershed Management Central Sulawesi.

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The type and amount of social and environmental benefits that REDD+ can deliver depend on where and how actions are implemented. The potential benefits of implementing REDD+ actions in a certain location are influenced by a range of factors, including the biophysical, geographic, socio-economic and cultural characteristics of the area. Maps can support decisions on where and how to put REDD+ into practice by conveying spatial information in an easily accessible way. This brochure presents a set of maps that have been developed for decision-makers in the UN-REDD Programme pilot province Central Sulawesi, Indonesia, and gives some guidance for their interpretation.

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