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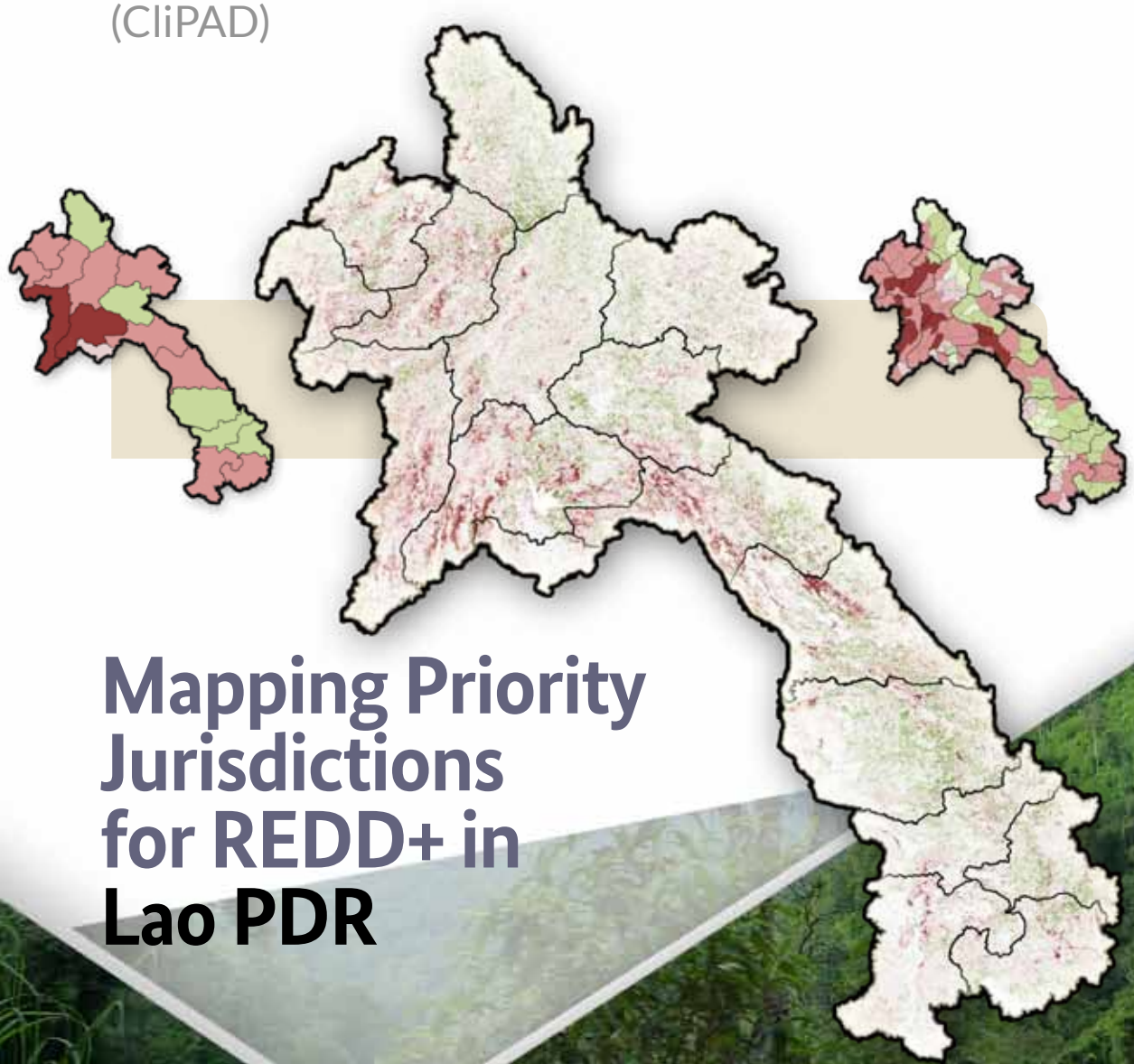

Mapping Priority Jurisdictions for REDD+ in Lao PDR

Analysis and Priority Rankings

Gabriel Eickhoff, Kyle Hemes,
Jeremy Ferrand and Sithong Thongmanivong

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Climate Protection through Avoided Deforestation Programme (CliPAD) Department of Forestry That Dam Campus, Chanthaboury District PO Box 1295
Vientiane, Lao PDR
T: +856 21 254082
F: +856 21 254083
Website:
www.giz.de
Authors:
1 – Gabriel Eickhoff, Kyle Hemes and Jeremy Ferrand, PT Forest Carbon Consultants
2 – Sithong Thongmanivong, Faculty of Forestry, National University of Laos.

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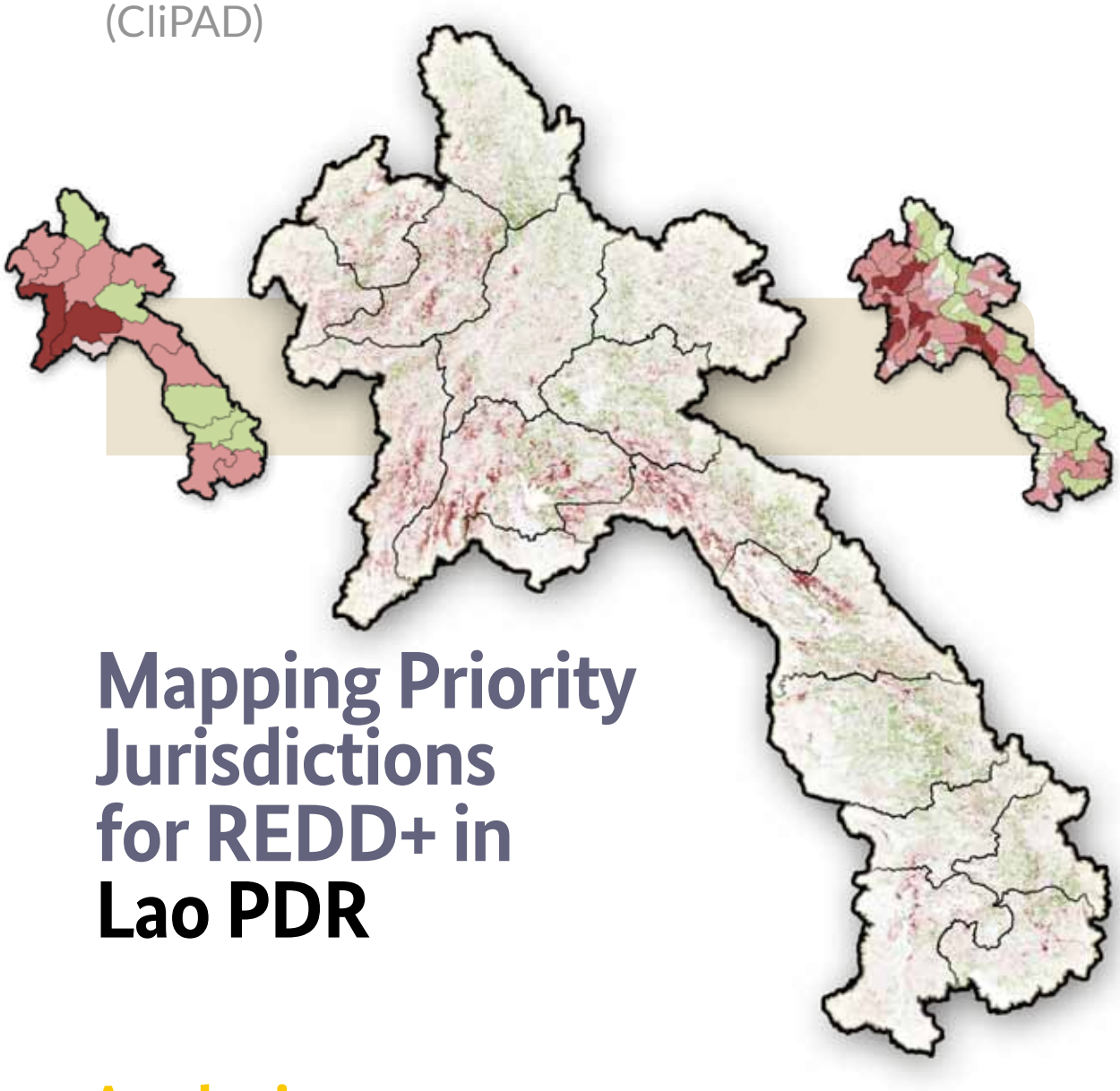

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Executive Summary

PURPOSE OF REPORT

As Lao PDR continues to advance with national and sub-national planning on Reducing Emissions from Deforestation and Forest Degradation and the enhancement of carbon stocks (REDD+), particularly with respect to Jurisdictional and Nested REDD+ (JNR) approaches, it is urgently necessary to develop a comparative understanding of jurisdictional priorities for REDD+. This report aims to provide the Government of Lao PDR (GOL) and development partners with a comprehensive comparison of priority jurisdictions and forest use categories through an analysis of historical changes in tree cover and carbon trends.

This report does not attempt to report specific changes in the number of hectares of tree cover or the number of hectares of change in tree cover per year. Rather it uses 11-year trends in 6.25 hectare pixels that each describe a percentage of tree cover. Likewise, the carbon stock values used in this report reflect global values derived at the Tier-1 level. These datasets are intended to extract trends and average values and should not be considered or used as a substitute for national or sub-national Reference Levels/Reference Emission Levels (RL/RELs).

This framework for prioritization should be updated with newer and finer-resolution data as it becomes available in the future as part of the national and sub-national RL/REL development process. It is ultimately intended for this report to be an overall lookup guide on trends in tree cover change and associated carbon stocks using global datasets that can provide a consistent and comparative basis with other countries.

FINDINGS

Priority Provincial Jurisdictions

- **Five highest priority Provinces for REDD+:** Xayabouri, Vientiane, Bolikhamxay, Oudomxay and Bokeo.
- **Five lowest priority Provinces for REDD+:** Xieng Khouang, Saravane, Sekong, Savannakhet and Phongsali.

  Priority Forest Use Categories
- **Highest overall priorities for REDD+ in terms of forest use categories** are in Production Forest Areas (PFAs) and Non-Categorized Forest areas.
- **Lowest overall priorities for REDD+ in terms of forest use categories** are in National Protection Forest (PTAs) and National Protected Areas (NPAs).
- Within each of the national forest categories, **some individual forest management units have above average priorities and are deserving of individual study.**

REDD+ PRIORITY VS. REDD+ POTENTIAL

REDD+ Priority is treated as an objective comparison of areas where forest-based emissions have likely been highest and lowest as a result of large-scale changes having occurred in association with given carbon stocks, regardless of the source or the ability to mitigate those sources. Thus, "priority" refers to areas with comparatively higher emissions and is intended to be a first step to guide further, more detailed, investigation of REDD+ operational potential and feasibility studies in the specific high-priority areas.

REDD+ Potential should be understood as being related to feasibility. Once high priority areas have been identified, it is the responsibility of the users of this report to narrow their focus down to understanding the local and historical dynamics of their area of interest. REDD+ Potential should be understood as a combination of the following factors:

1. **Technical Potential** – Is the proposed REDD+ activity occurring in an area that is actually generating significant emissions? Can those emissions be measured and effectively monitored?

2. **Operational Potential** – Can the emissions source actually be mitigated?

3. **Financial Potential** –An assessment of the financial value of the projected emission mitigation commodities as compared to the long-term operational and monitoring costs, and;

4. **Political/Policy Potential** – Does the policy framework support the type of REDD+ activity in mind and is there political willingness to implement it?

Foreword

As part of its aim to support economic growth and poverty alleviation, the Government of the Lao PDR (GoL) is committed to the sustainable development of the nation's rich natural capital. Increasing national forest cover and revenues from land management have been identified as vital initiatives within the Lao National Socio-Economic Developments plans. Lao PDR also signed the United Nations Framework Convention on Climate Change (UNFCCC) and developed a National Climate Change Strategy to address the serious problem of climate change. Implementing Reducing Emissions from Deforestation and Forest Degradation and the enhancement of carbon stocks (REDD+) in this context gives options to reduce emissions from the forestry sector and mitigate climate chance as well as generating revenues for the sustainable development of Lao PDR.

As Lao PDR continues to advance with planning to implement this scheme, it was necessary to develop a comparative understanding of priorities for REDD+ interventions. This report aims to provide a comprehensive comparison of priority districts and provinces as well as forest land categories through an analysis of historical changes in forest cover and carbon trends.

It is hoped that this information can be used as an initial guide to understand the overall spatial distribution of priorities of where REDD+ investments and interventions in Lao PDR would be needed and contribute to Lao PDR's REDD+ readiness. The study was conducted within the Lao-German Climate Protection through Avoided Deforestation Programme (CliPAD) of the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), with funding from the German Federal Ministry for Economic Cooperation and Development (BMZ). It was commissioned by the REDD+ Task force and implemented as a joint initiative with the Faculty of Forestry of the University of Laos, the Ministry of Agriculture and Forestry (MAF) and the Ministry of Natural Resources and Environment (MONRE) with peer reviews from several international experts. I would hereby like to thank all participants for their efforts in this very valuable initiative to bring Lao PDR's REDD+ readiness forward.

Mr. Vongdeuane VONGSIHARATH
Director General of the Department of Forest Resource Management, MONRE
Head of REDD+ Task Force

ONE

Introduction

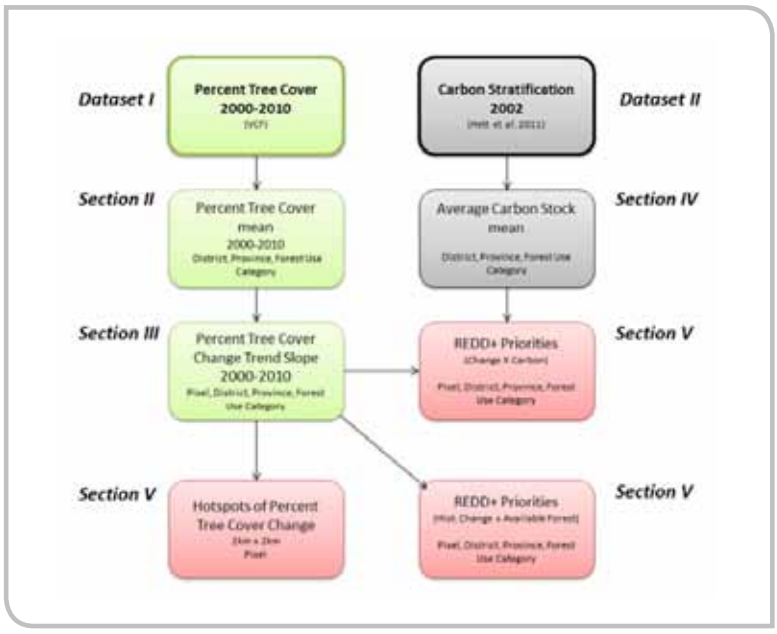
This study provides a comparative prioritization of each jurisdictional unit in Lao PDR, broken down by province, district and national forest use category. Comparisons are made based on a historical analysis of percent tree cover change, a 2002 forest carbon stratification made explicitly for Lao PDR and considerations of known large-scale historical trends.

Building on a previous study in Lao PDR by SNV, this report advances several newly available datasets covering a longer, continuous time period. For assessing land cover change, the new finer-resolution (250m x 250m) Vegetation Continuous Fields (VCF Collection 5) global dataset from the Global Land Cover Facility is analyzed on an 11-year historical time horizon. For carbon stock densities, a carbon stratification specific to Lao PDR (100m x 100m resolution) is used.

Lastly, while the VCF data analysis is used to gather jurisdiction-wide trends reflecting overall net changes occurring from a variety of land use and land use change patterns; specific regions with large-scale changes in vegetation indexes are also identified in a historical "hotspots analysis". In order to further understand non-recurrent, large-scale trends that could potentially skew business as usual jurisdictional historical changes, hotspots were generated by considering significant change in percent tree cover within 2kmx2km pixels. This allows the user to focus on areas of large-scale geographic changes and eliminate geographically smaller scale changes.

The following diagram shows the major steps of the data analysis process and sections of this report:

Figure 1: Stepwise process and relationship for the completion of each section of this report.



1. Holland, T., and R. McNally. 2000. Mapping Potential for REDD in Lao PDR, Forest cover, tree cover change, and forest carbon density. SNV Publication.
2. DiMiceli, C.M., M.L. Call, R.A. Sohlberg, C. Huang, M.C. Hansen, and J.R.G. Townshend. 2011. Annual Global Automated MODIS Vegetation Continuous Fields (MOD44B) at 250 m Spatial Resolution for Data Years Beginning Day 65, 2000 - 2010, Collection 5 Percent Tree Cover, University of Maryland, College Park, MD, USA. Source: http://glcf.umiacs.umd.edu/data/vcf/
3. Hett, C., Heinimann, A., and P. Messerli. 2011. Spatial assessment of carbon stocks of living vegetation at the national level in Lao PDR. Danish Journal of Geography 111(1): 11-26, 2011

TWO

Percent Tree Cover Mapping

DATA USED AND TREATMENT

Percent tree cover data was acquired from the Global Land Cover Facility's recently updated Vegetation Continuous Fields (VCF) Collection 5 dataset. This dataset has been used extensively around the world to assess static and temporal percent tree cover changes[4], including in Brazil[5], Congo[6] and Southeast Asia. This highly peer reviewed global dataset describes pixels in terms of percent tree cover, percent non-tree vegetation and percent bare land at a resolution of 250m x 250m (6.25 ha). Each pixel is a composite of all three of these factors and is ultimately expressed as a percentage of tree cover. The VCF dataset was generated through an algorithm that has undergone continued modification and refinement over time and based on fine and ultra-fine resolution imagery. The original MODIS (MOD44B) surface reflectance composite was trained on high-resolution imagery with an automated algorithm using 30 independent regression trees. Additional information on the MODIS VCF Dataset is available from the Global Land Cover Facility[7].

Compared to other land cover datasets, the VCF product avoids setting arbitrary thresholds for different types of cover. Instead, it expresses each pixel as a percent of tree cover (see Figure 2). In this report, average percent tree cover values are generalized by pixel (Figure 3), province (Figure 4) and district (Figure 5) as well as forest use category. Percent tree cover averages were derived for each of the 11 years ranging from 2000-2010.

The following example below illustrates the process for Luang Prabang Province in 2007.

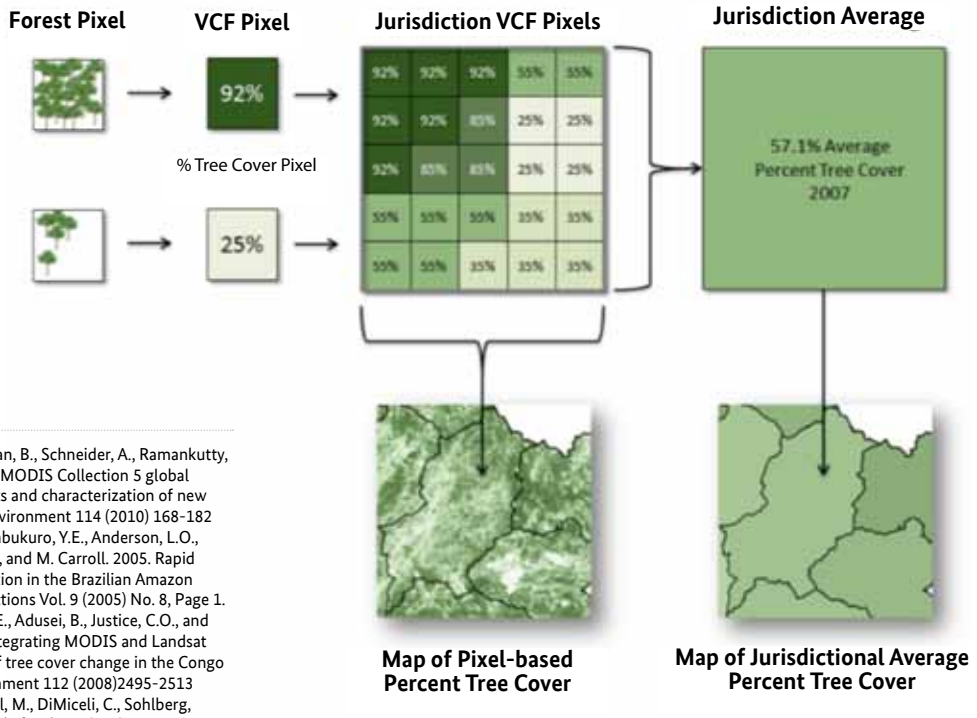


Figure 2: Representation of VCF percent tree cover pixels and generalization to jurisdictional averages.

4. Friedl, M.A., Sulla-Menashe, D., Tan, B., Schneider, A., Ramankutty, N., Sibley, A., and X Huang. 2010. MODIS Collection 5 global land cover: Algorithm refinements and characterization of new datasets. Remote Sensing and Environment 114 (2010) 168-182
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6. Hansen, M., Roy, D.P., Lindquist, E., Adusei, B., Justice, C.O., and A. Altstatt. 2008. A method for integrating MODIS and Landsat data for systematic monitoring of tree cover change in the Congo Basin. Remote Sensing of Environment 112 (2008)2495-2513
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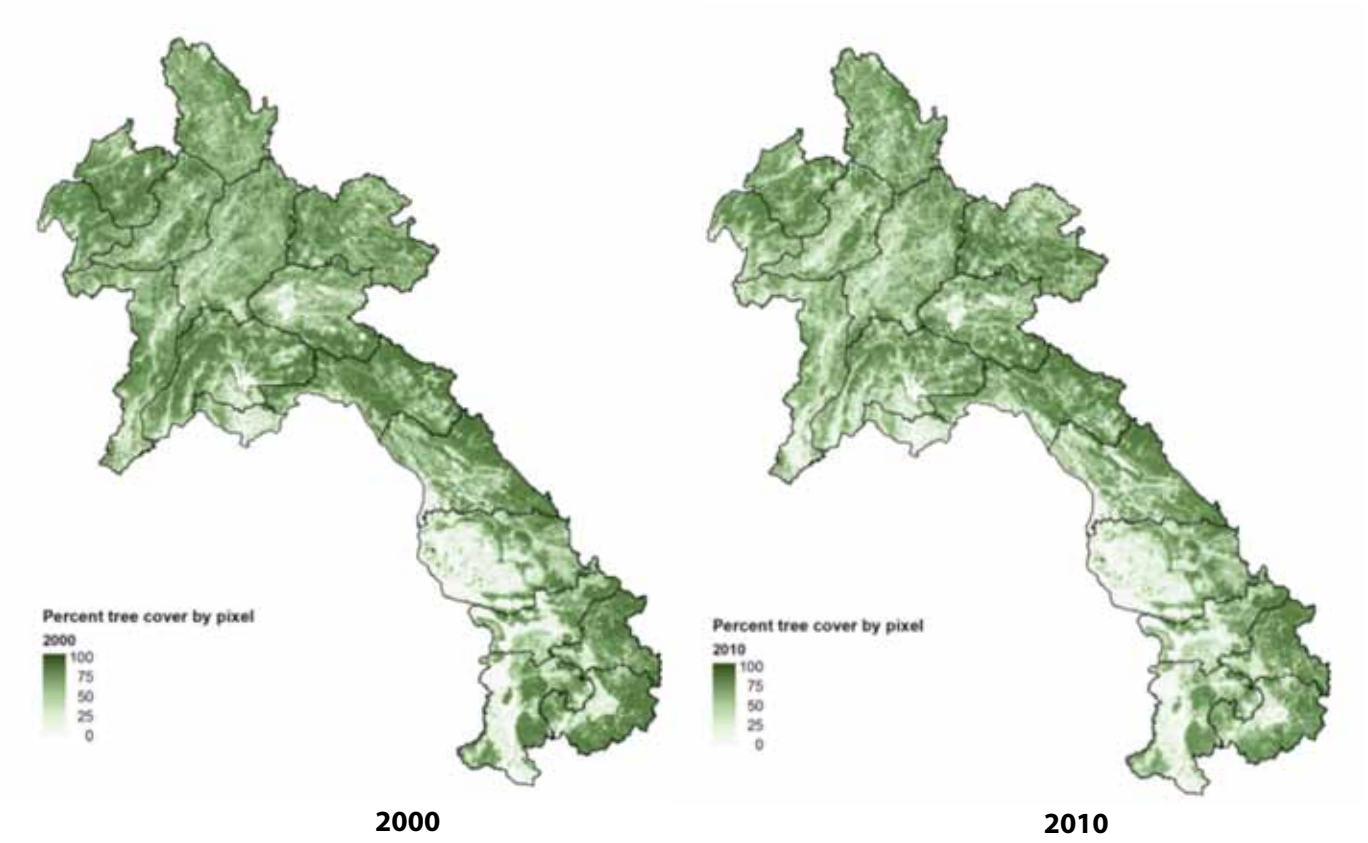


Figure 3: Percent tree cover in 2000 and 2010 by pixel.

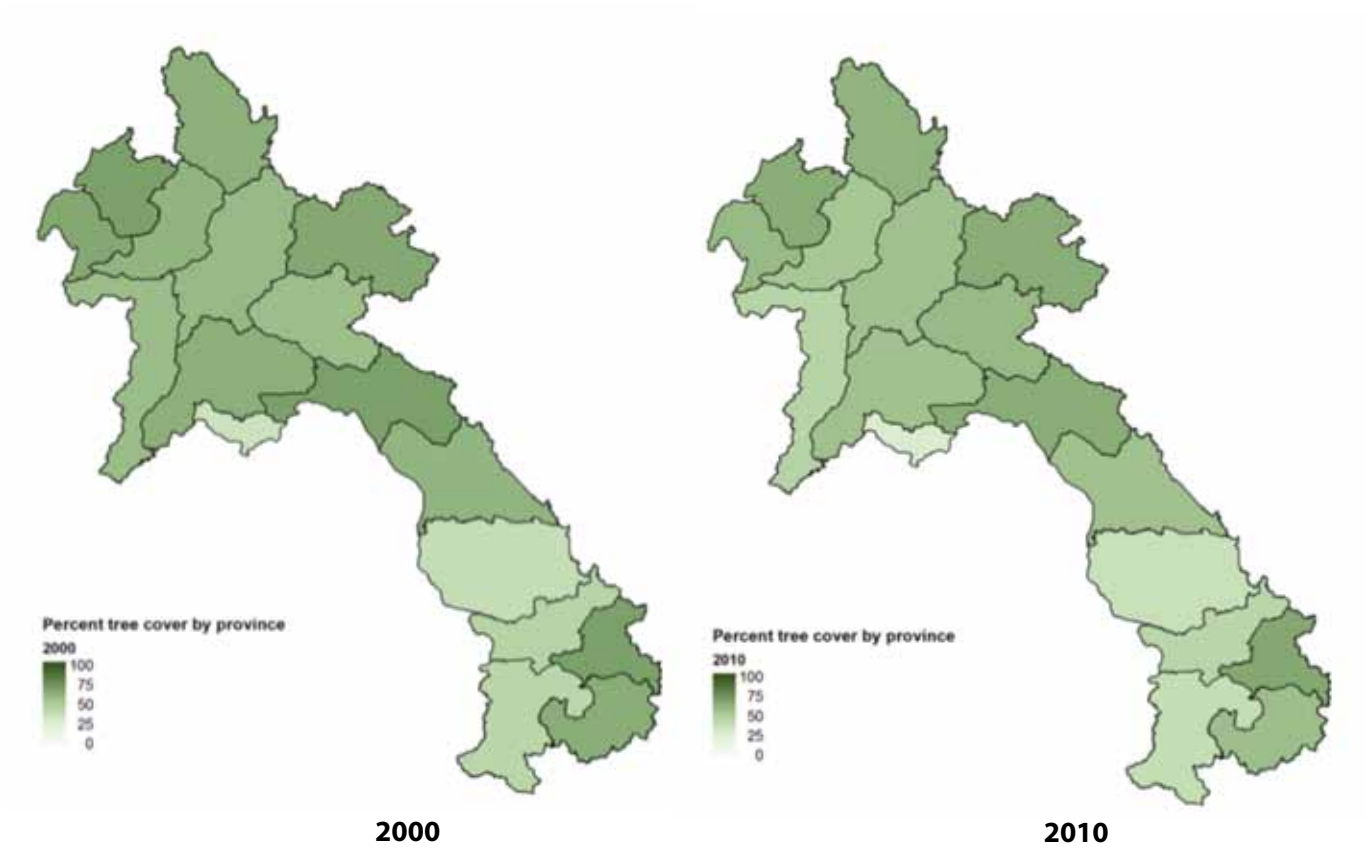


Figure 4: Average percent tree cover in 2000 and 2010 by province.

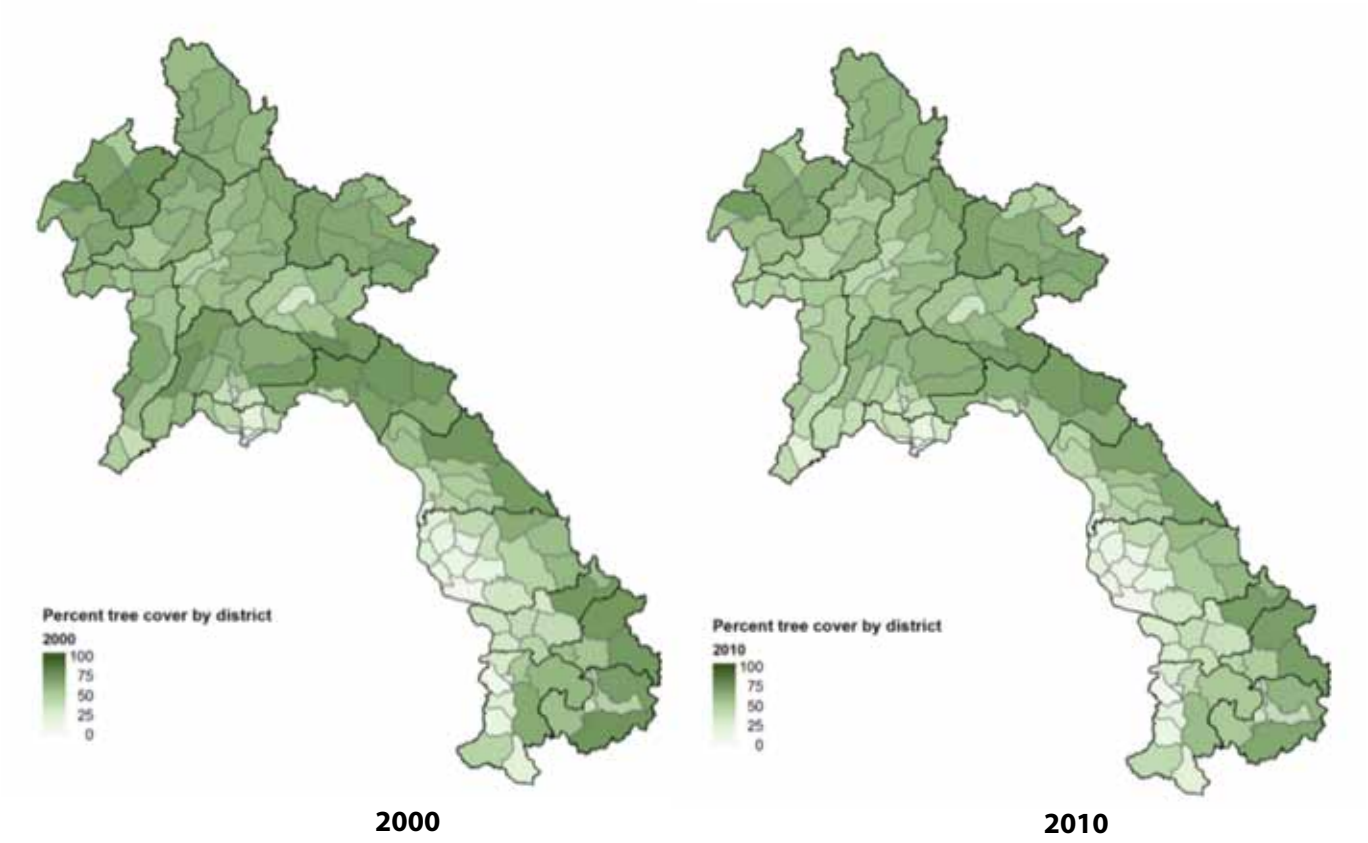


Figure 5: Average percent tree cover in 2000 and 2010 by district.

ACCURACY AND INTERNAL VALIDATION

Despite the abundance of accuracy assessments and peer review processes of VCF data on an international level, quality was assessed independently to determine overall suitability of the data to accurately inform provincial and district level trends in Lao PDR. As compared to traditional forest/non-forest classifications using a binary system, VCF data is continuous in nature. This poses a challenge when trying to compare VCF data using a standard accuracy/confusion matrix because continuous values cannot be directly assessed against binary forest/non-forest values.

In order to assess the suitability and meaningfulness of the data, it was necessary to consider the accuracy through i) VCF in terms of forest/non-forest hectares by invoking an estimated threshold; ii) analyzing VCF in terms of % tree cover as compared to landsat imagery processed to produce a Forest Canopy Density[8] (FCD); or iii) through the comparison of percent tree cover change with gains, losses and persistence of landsat-based forest/non-forest pixels. Items i and iii were undertaken for this report, while ii was deemed to be beyond the scope of the current study. A complete supplementary report[9] is available describing the process and results. The following quantitative and qualitative assessments were undertaken:

continues on following page...

8. Rikimaru, A., Roy, P.S., and S. Miyatake. 2002. Tropical tree cover density mapping. Tropical Ecology 43(1): 39-47
9. Hemes, K., Ferrand, J., and G. Eickhoff. 2013. Mapping Priority Jurisdictions for REDD+ In Lao PDR, Internal Validation and Accuracy Assessment Supplementary Document. Prepared for the GIZ Climate Protection Through Avoided Deforestation (CliPAD) project.

1) **Quantitative:** Pearson correlation coefficient between VCF % change and Landsat F/NF change
   a) Provincial Level (Sayabouri, Khammouane and Houaphan Provinces)
   b) District Level (Districts of Khammouane Province)

2) **Quantitative:** Receiver Operating Characteristic (ROC) test of province-wide VCF % change and Landsat forest/non-forest change

3) **Quantitative:** Year-by-year confusion matrix comparing pixel agreement between VCF (using a forest/non-forest threshold) and previously established Landsat forest/non-forest classifications.

4) **Qualitative:** Sensitivity to bio-geospatial and climactic variation

THREE

Percent Tree Cover Change Mapping

The VCF dataset provides annual wall-to-wall coverage of Lao PDR by 250 sqm pixels defining percent tree cover. Since each individual pixel can be tracked through time, an 11-year, pixel-based, statistical trend slope was established (see example in Figure 6) for every 6.25ha pixel in Lao PDR. Mean percent tree cover change values were then calculated by province, district and forest use categories.

We revisit the example of Luang Prabang province to see how percent forest change is analyzed over time in order to derive an 11-year historical slope. The same process was repeated both at the per-pixel and district levels.

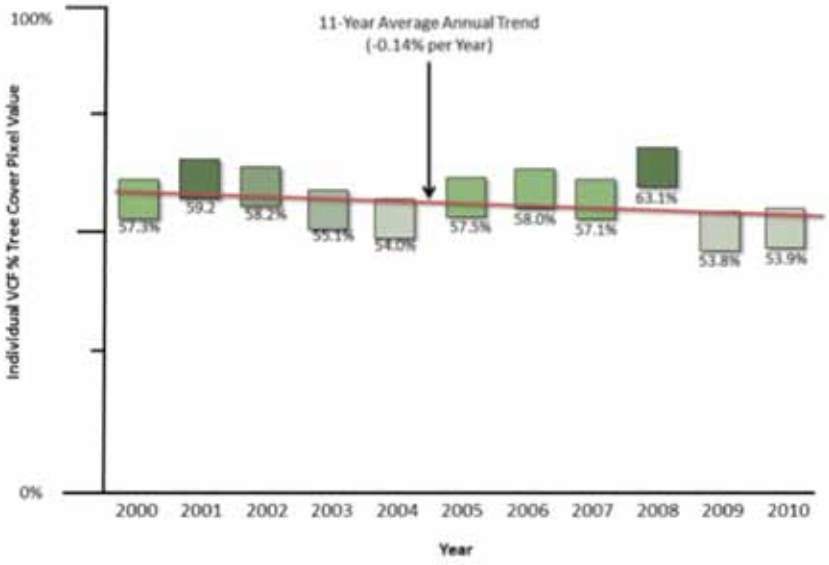


Figure 6: Above is an illustrative example of how 11-year historical trend line and slope are calculated for each pixel. The boxes in this diagram represent a single pixel, through time, with a corresponding % tree cover value. As pixel value changes, so does the color coding.

The following equation (Eq. 1) was used to calculate pixel slope:

Eq. 1 $$b_{pixel} = \frac{\sum_{pixel}(x - \bar{x})(y - \bar{y})}{\sum_{pixel}(x - \bar{x})^2}$$

Where:
- b_{pixel} = slope of 11-year VCF pixel value trend line
- x = time
- $\bar{x}$ = average time of series
- y = pixel percent tree cover
- $\bar{y}$ = average pixel percent tree cover

From this change mapping process, it is possible to begin to see regional trends of percent tree cover loss as well as percent tree cover gains (see Figure 7). This is interesting from the standpoint of trying to pinpoint regions of deforestation that may be suitable for project-level REDD+ interventions. For jurisdictional REDD+, it is important to view this data quantified as the statistical average across different administrative levels to isolate overall district and provincial trends. Figures 8 and 9 below provide a comparative view of the 11-year historical change in percent tree cover trends. Some of the largest net losses in percent tree cover can be seen in southern Vientiane Province, Sayabouri Province and Bolikhamxay Province.

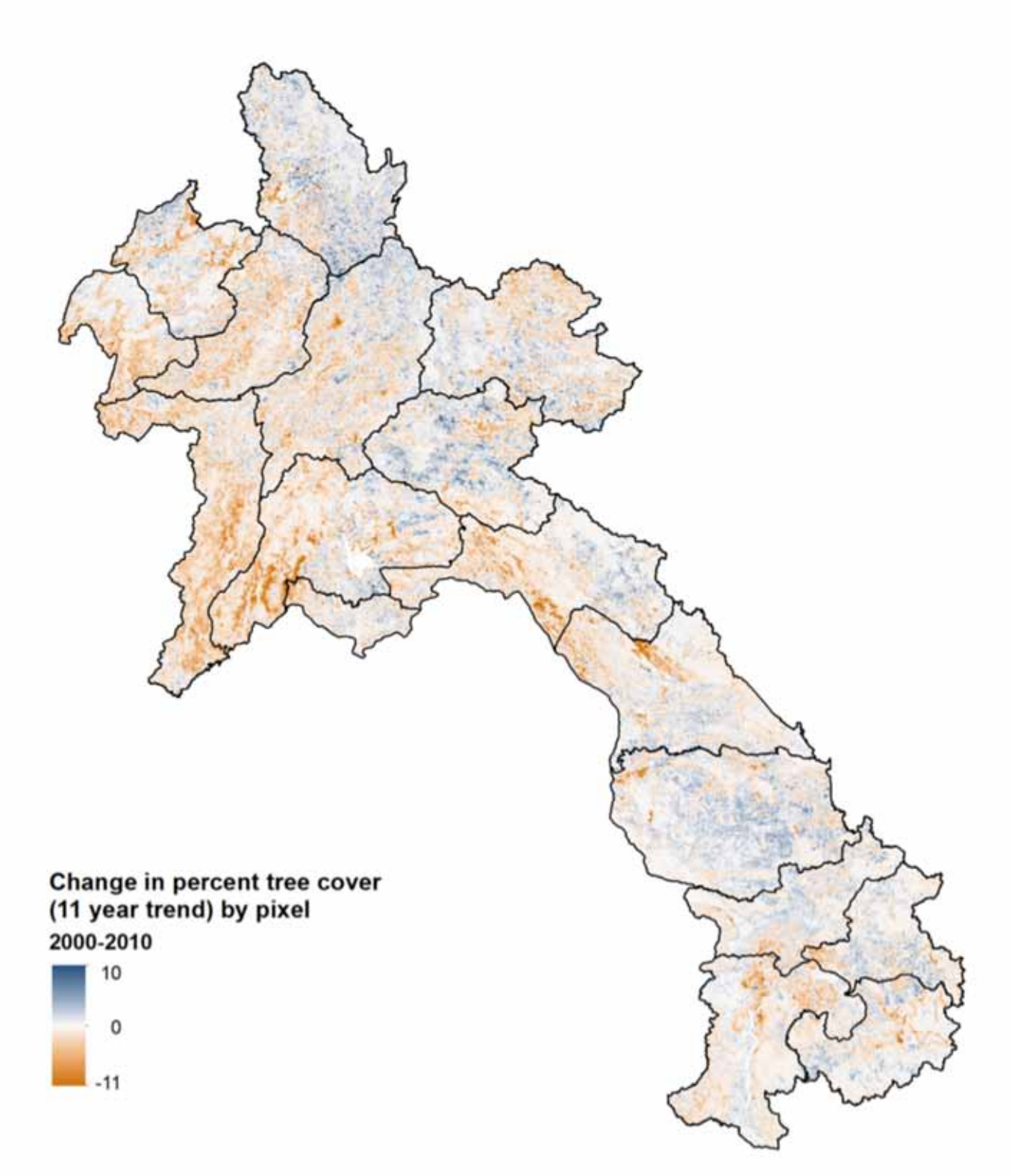


Figure 7: Percent tree cover change by pixel. Color values express 11-year trend line slope values of historical change (Annual % increase or decrease per year). Blue colors represent increasing slopes where tree cover has an 11-year increasing trend, whereas orange colors represent trends of decreasing percent tree cover.

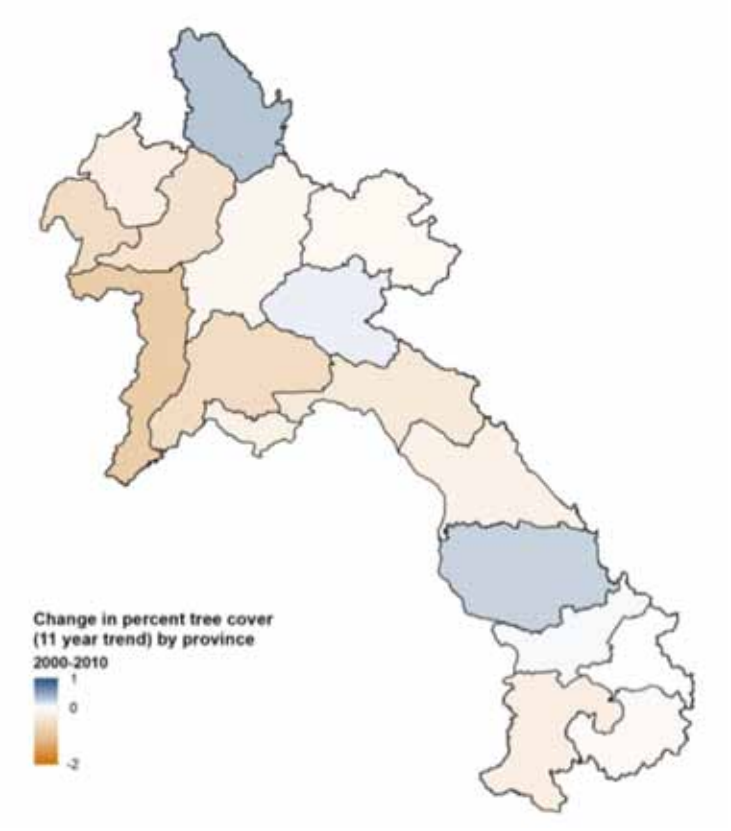


Figure 8: Percent tree cover change by Province. Color values express 11-year trend line slope values of historical change (Annual % increase or decrease per year). Blue colors represent increasing slopes where tree cover has an 11-year increasing trend, whereas orange colors represent trends of decreasing percent tree cover.

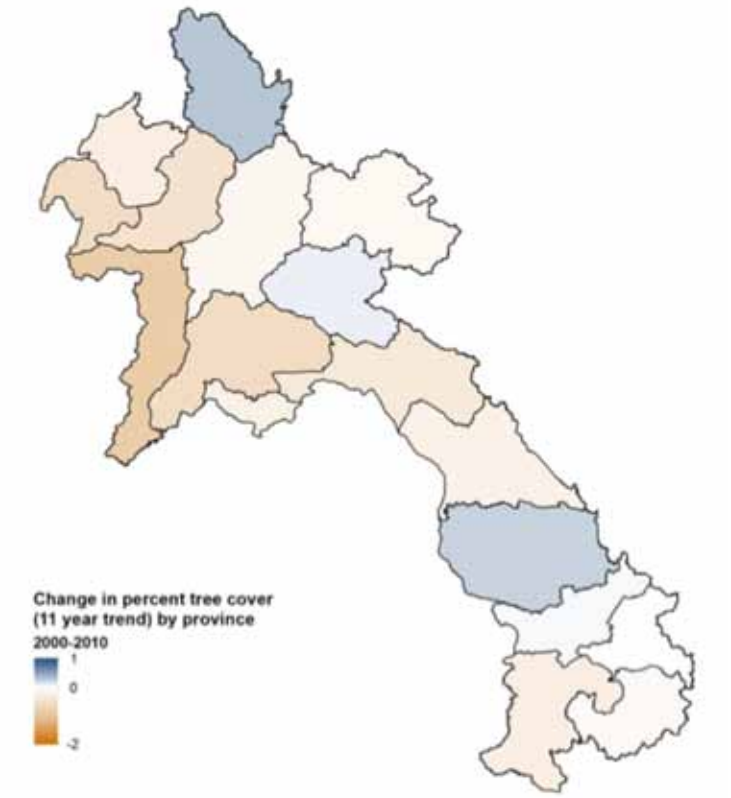


Figure 9: Percent tree cover change by district. Color values express 11-year trend line slope values of historical change (Annual % increase or decrease per year). Blue colors represent increasing slopes where tree cover has an 11-year increasing trend, whereas orange colors represent trends of decreasing percent tree cover.

While Figure 7 to Figure 9 indicate the average net value of these changes across district and provincial jurisdictional boundaries. While interesting to consider, there is also value in looking at the respective average 11-year averages. This is informative because while provinces such as Houaphan, Luang Prabang and Sekong may have near net zero changes; the magnitudes of the gross gains and gross losses are potentially quite different.

Figure 10 provides a more complete picture of the comparative landscape-wide dynamics occurring in different parts of the country. In general, provinces that are reaching near zero net change have gross annual slope averages of between +0.3/-0.3 and +0.4/-0.4, such as Houaphan, Luang Prabang, Sekong, Salavan, and Attapeu. Bokeo, Vientiane and Sayabouri all standout boldly with large losses as compared to very low gains.

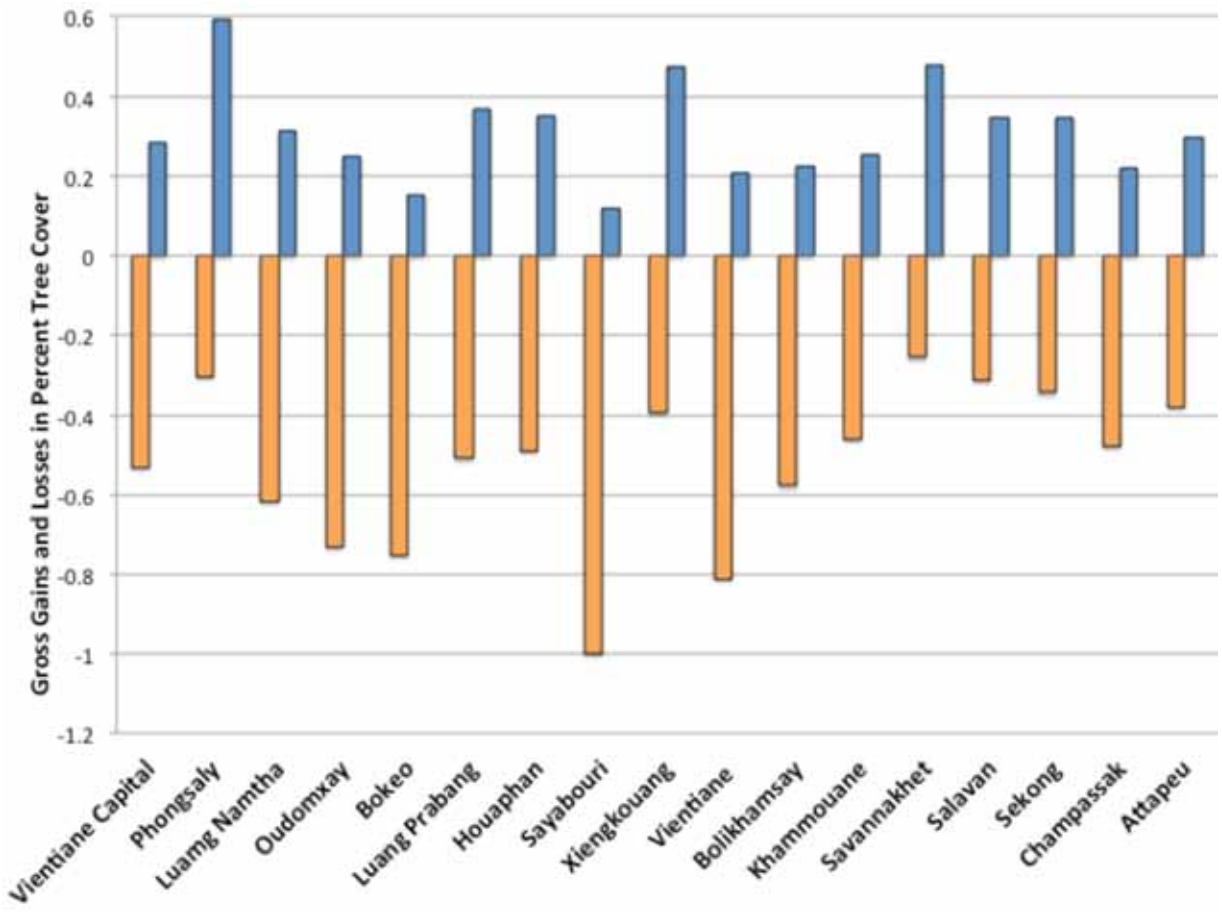


Figure 10: Average 11-year trend slopes of annual gross gain (blue) and gross loss (orange) in percent tree cover by province.

FOUR

Carbon Stock Density

While percent tree cover change provides some interesting insight into patterns and trends of land use and land use change, forest carbon stocks are critically important to understanding REDD+ jurisdictional priorities. Unlike carbon emissions, carbon stocks refer to the mass of carbon contained in biomass. Carbon stock density explains the average carbon stock per pixel or hectare. In this case, we can also generalize to a higher level by referring to the average carbon stock density per hectare of a province or a district.

Investments in planning and mitigation of deforestation in areas of low carbon stocks are unlikely to result in substantial emission reductions. Likewise, areas of high carbon stock with low historical or current risk of deforestation are also unlikely to yield favorable REDD+ results for stakeholders.

While carbon stocks can be inferred from satellite imagery by extrapolating default values identified by the Intergovernmental Panel on Climate Change[10] (IPCC), carbon stocks are more accurately derived from ground level sampling and national-level inventories, taking into consideration the complexities of forest types, ecology, geography, accessibility and threat. In later stages of national stratification, forest areas can be first grouped into nationally recognized ecological classes and then surveyed on the ground to sample above and belowground carbon pools. Once forest classes are analyzed, they can be grouped and generalized into discrete carbon strata layers.

A limited number of global carbon stock data sources are now available[11 12] that consider above and belowground biomass. This study uses a 100m x 100m resolution biomass carbon stock map to describe tons of carbon per hectare (tC/ha) in aboveground biomass only. This dataset was prepared specifically for Lao PDR by Hett et al.[13] (as represented by Figure 11) and is based largely off of the 2002 National Forest Inventory (NFI 2002) classification of Lao PDR. Hett et al. (2011) combines high-resolution imagery from Google Earth, medium resolution Landsat imagery and an NDVI analysis of 16-day MODIS (MOD13Q1) satellite imagery in order to refine the NFI 2002 map. This refined NFI dataset was further stratified with FAO Ecological Zones. Lastly, carbon stock densities were adapted from the IPCC values to take into consideration upland shifting cultivation dynamics and forest degradation. Because this carbon stock dataset takes into consideration dynamics such as rice paddy, agricultural land, grassland and shrubs as well as degraded and natural forest, it is able to capture stock density dynamics of land use patterns as well as forest and forest degradation.

Lastly, average carbon stock densities were then generalized to jurisdictional levels by calculating the mean value of all carbon stock pixels in each province (Figure 11) and district (Figure 12). These values are then used as the base carbon stock values by which VCF data is compared to analyze the dynamics of carbon stock gain and loss.

10. IPCC 2006. Guidelines for National Greenhouse gas Inventories; Volume 4 – Agriculture, Forestry, and Other Land Use. Source: http://www.ipcc-nggip.iges.or.jp/2006gl/vol4.html
11. Ruesch, Aaron, and K. Gibbs. 2008. New IPCC Tier-1 Global Biomass Carbon Map for the Year 2000. Available online from the Carbon Dioxide Information Analysis Center http://cdiac.ornl.gov/epubs/ndp/global_carbon/carbon_documentation.html
12. Saatchi, S.S., Harris, N.L., Brown, S., Lefsky, M., Mitchard, E., Salas, W., Zutta, B., 10 Buermann, W., Lewis, S., Hagen, S., Petrova, S., White, L., Silman, M., Morel, A. 2011. 11 Benchmark map of forest carbon stocks in tropical regions across three continents. Proc. Nat. Acad. Sci. Early Edition.
13. Hett, C., Heinimann, A., and P. Messerli. 2011. Spatial assessment of carbon stocks of living vegetation at the national level in Lao PDR. Danish Journal of Geography 111(1): 11-26, 2011

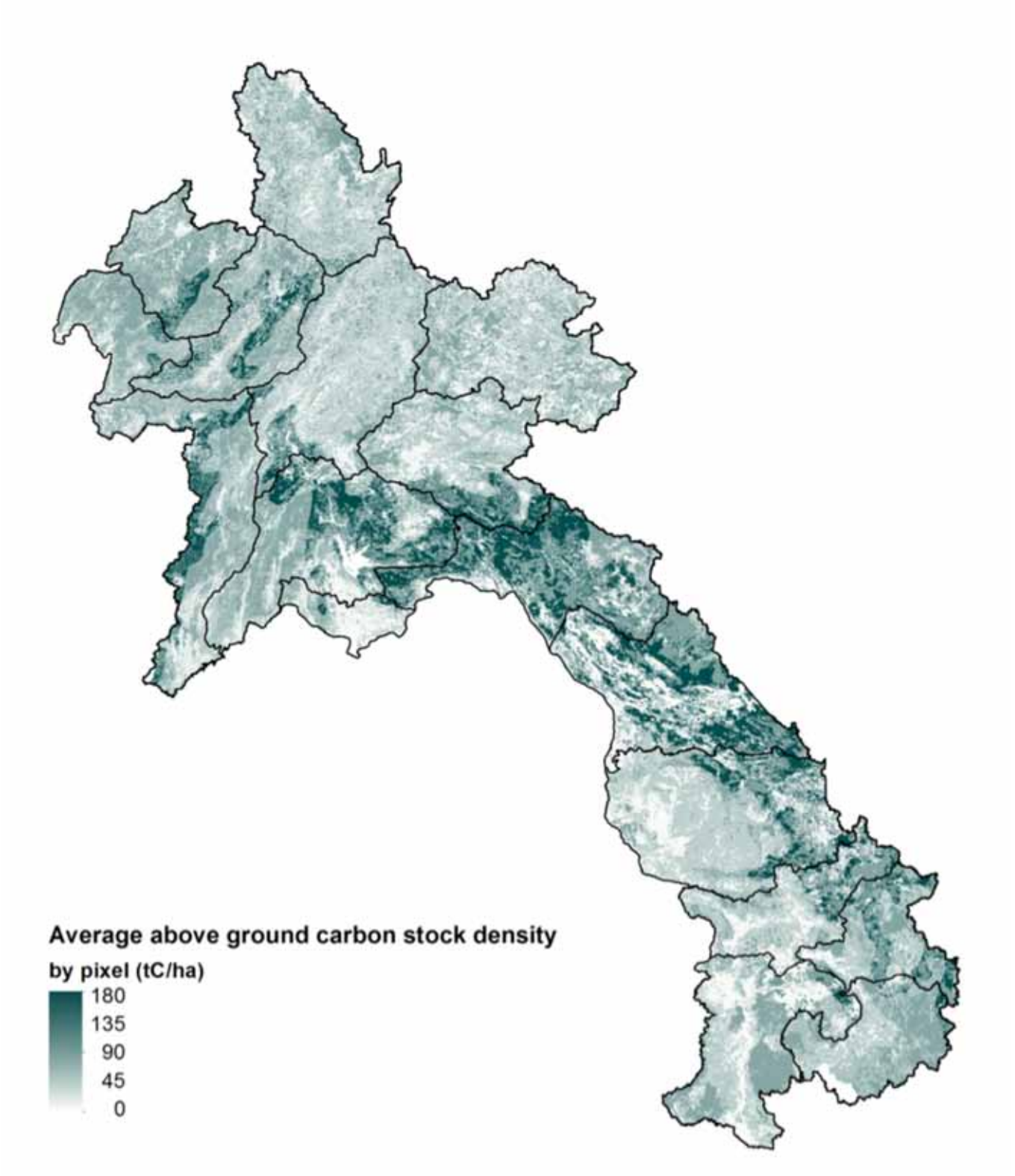


Figure 11: Carbon stock densities by pixel (2002) after Hett et al. 2011).

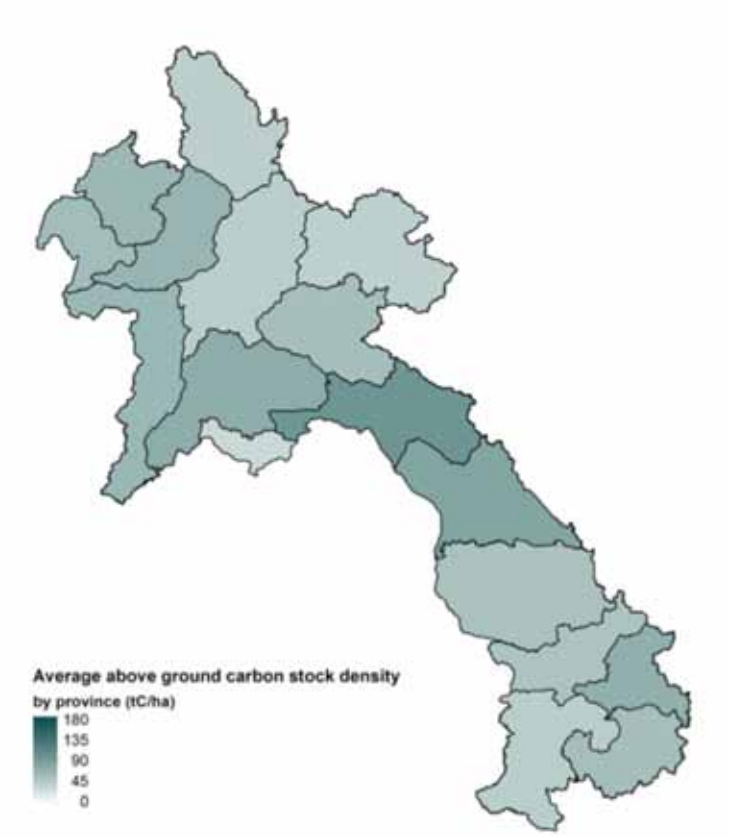


Figure 12: Average carbon stock densities by province (2002).

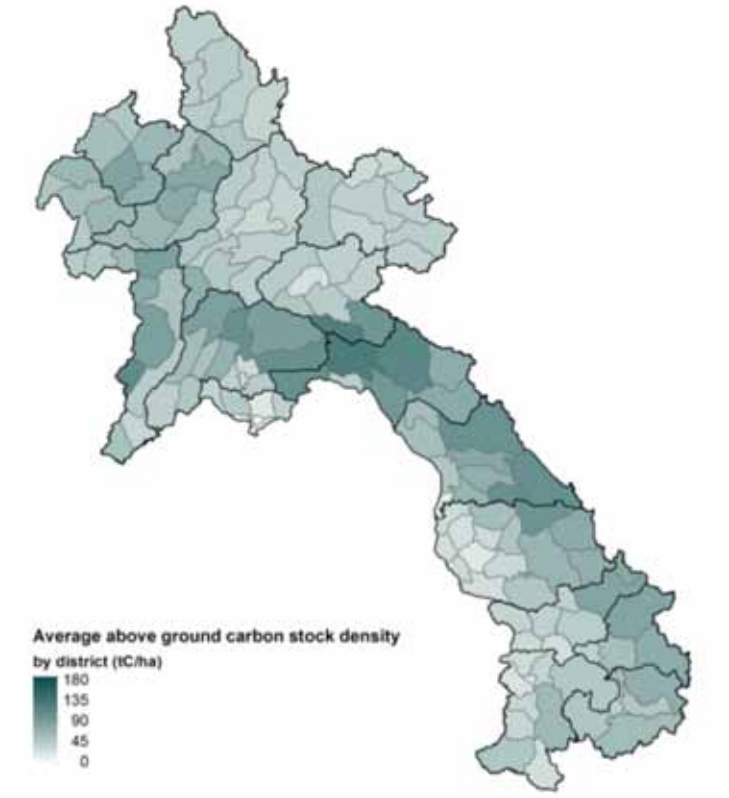


Figure 13: Average carbon stock densities by district (2002).

FIVE

REDD+ Priority Jurisdictions

By compiling percent tree cover change trend slopes and 2002 carbon stock densities for each pixel, district and province, we are able to begin prioritizing areas and jurisdictions that could be of high priority for REDD+ interventions.

This section identifies these areas based on the following three groupings: 1) the identification of jurisdictions based on historical rates of change as compared to the average percent tree cover remaining (as of 2010) by district and province; 2) historical rates of change as compared to average carbon stock densities by district, province and forest use category; and 3) the identification of large-scale "hot-spot" changes across the entire national landscape.

TABLES AND SCORING

Scoring is based on the multiplication of 11-year change slope pixels multiplied by a corresponding 2002 carbon stock density pixel. This provides us with an indication of historical gains and losses in carbon strata. Average Carbon Density (tC/ha), 11-year Trend (%change/year)in order to generate a resulting "Priority Score" (Figure 14).

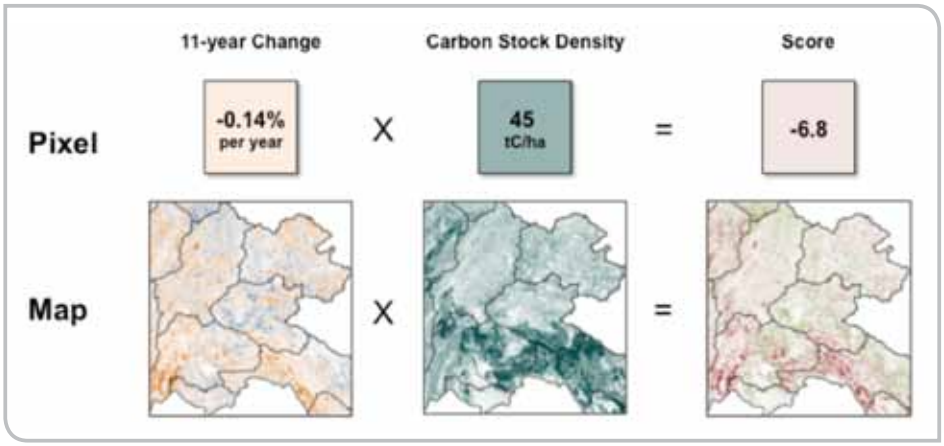


Figure 14: Scoring is based on 11-year net change in percent tree cover pixels multiplied by 2002 carbon stock density pixels

Jurisdictional priority scoring is generated based on taking the average score across a jurisdictional boundary (average of the sum of historical change multiplied by carbon stock), as seen in Eq. 2. Thus, large changes in % tree cover associated with high carbon stock densities produce higher scores than equally large changes in % tree cover associated with low carbon stock density pixels. This helps increase scoring accuracy as compared to a straight jurisdiction-wide x-y scatter-plot comparison (Figure 16 – Figure 20). Scoring in Section VI is based on the following equation:

Eq 2 $$Score_{Jurisdiction} = \overline{\sum_{Jurisdiction} (b_{pixel} \bullet C_{pixel})}$$

Where: $Score_{jurisdiction}$ = *Average sum product of carbon stock density pixels multiplied with congruous 11-year slope pixels*
b_{pixel} = slope of 11-year VCF Pixel value trend line
C_{pixel} = Carbon stock density pixel value

AVERAGE CARBON DENSITY AND PAST TREE COVER CHANGE

The geospatial location of carbon emissions must be the focal point of REDD+ mitigation planning. Here, 11-year percent tree cover trend line slopes (Figure 7) mapped against carbon stock (Figure 11) and average carbon stock densities (Figure 12 and Figure 12), creating composite maps of historical percent tree cover change and carbon stock by pixel (Figure 15), and average carbon stock densities by province and district (Figure 16 and Figure 17respectively). A detailed lookup table is available in Section VI.

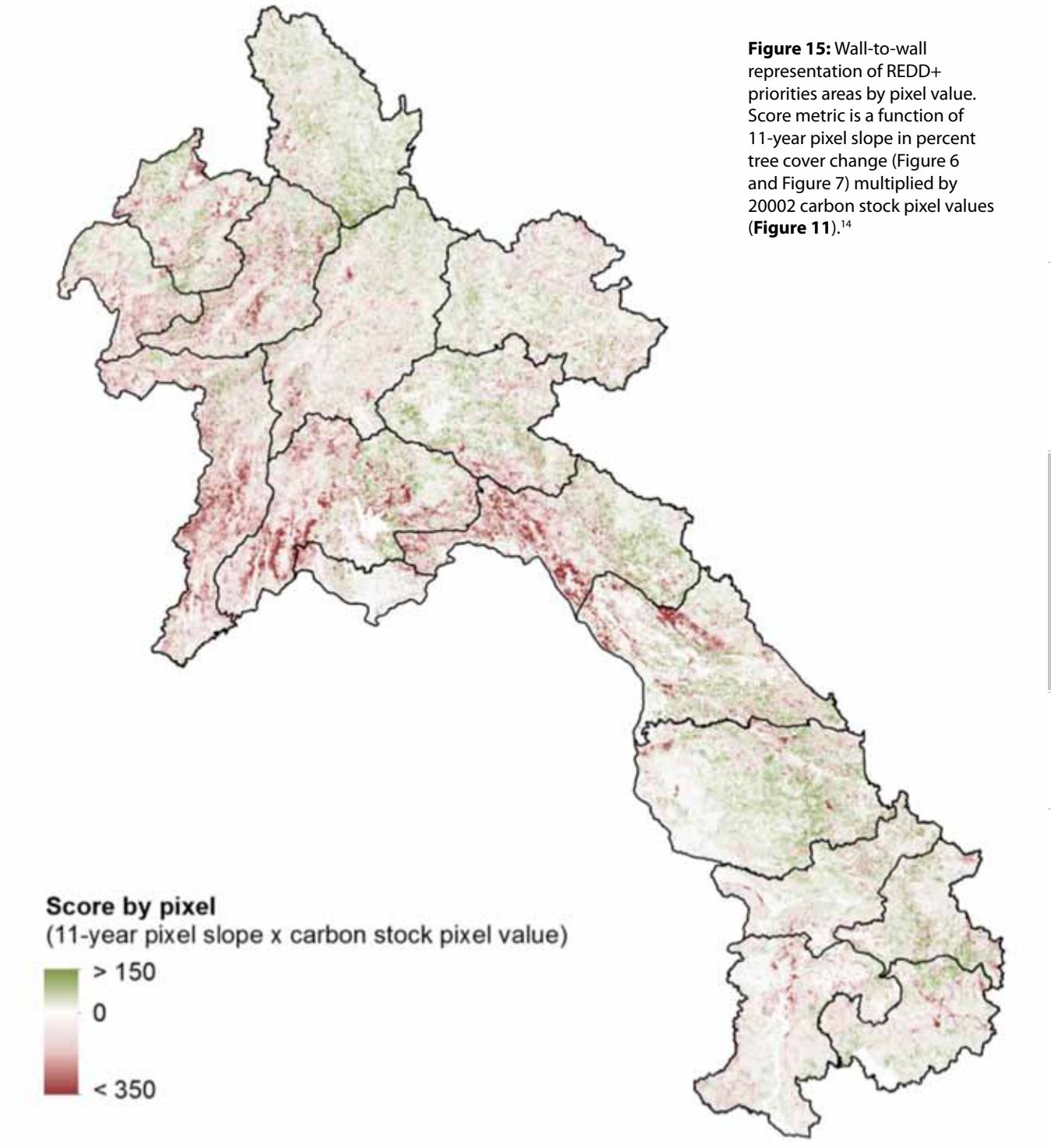
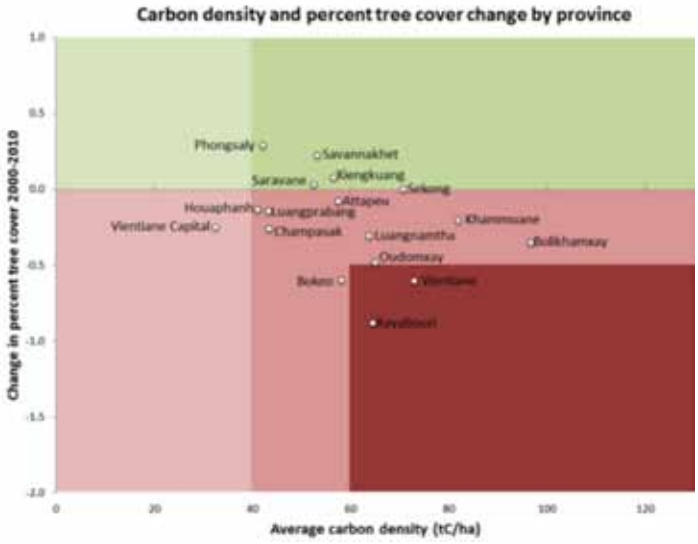


Figure 15: Wall-to-wall representation of REDD+ priorities areas by pixel value. Score metric is a function of 11-year pixel slope in percent tree cover change (Figure 6 and Figure 7) multiplied by 20002 carbon stock pixel values (**Figure 11**).[14]

14. 100m2 carbon stock pixels (Hett et al. 2011) were resized and re-gridded to spatially align with the 250m2 VCF pixels.

Figure 16: Wall-to-wall representation of REDD+ priorities by province. See Section VI for a detailed lookup table.



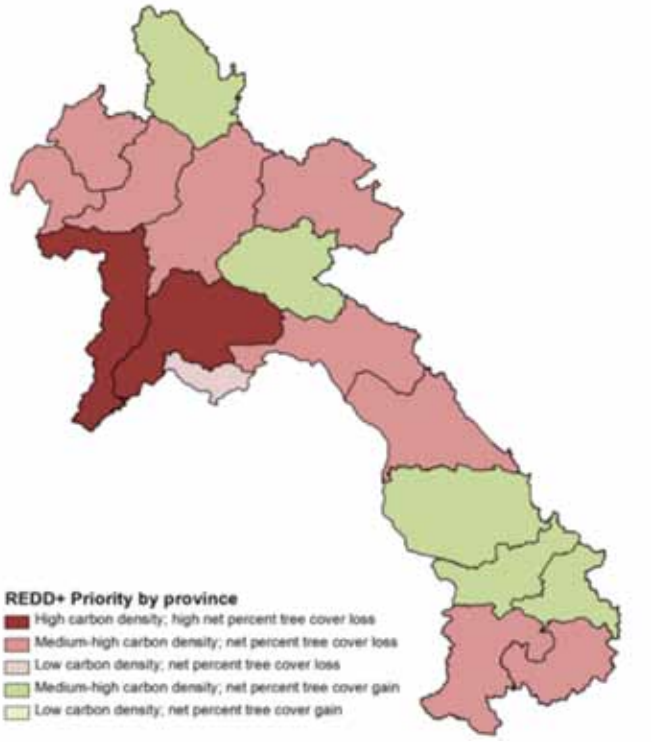
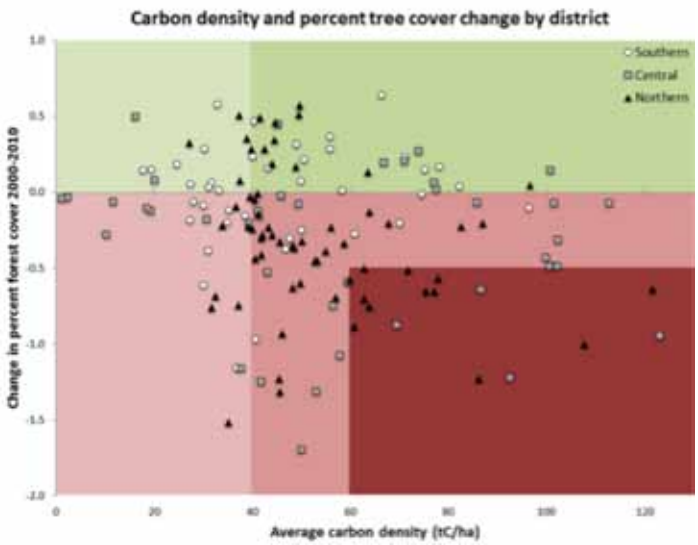
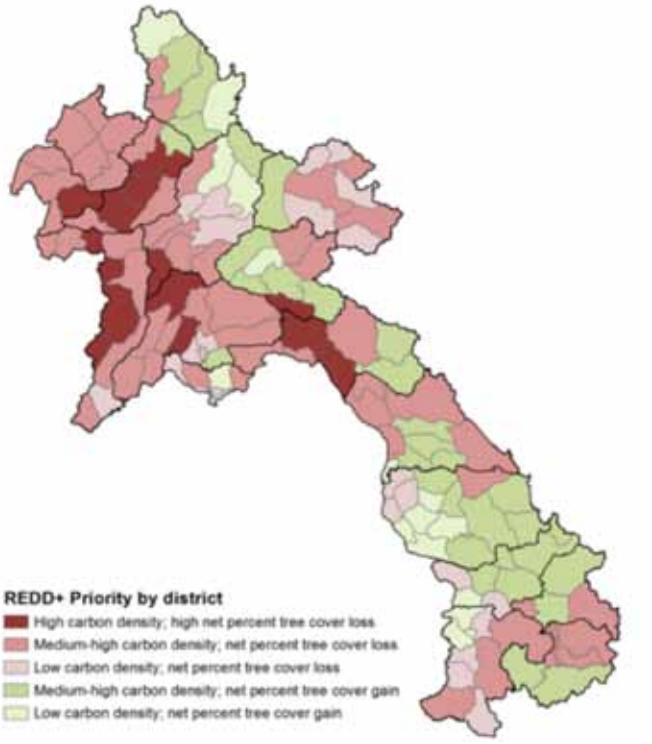


Figure 17: Wall-to-wall representation of REDD+ priorities by district. See Section VI for a detailed lookup table.





CURRENT TREE COVER AND PAST TREE COVER CHANGE

While ideal locations for REDD+ interventions are forests with significant carbon stocks that are also at immediate threat of deforestation and degradation, it is also important to quantify how much forest currently remains to be deforested in order to anticipate trends into the future. Here, we plot the 11-year change in percent tree cover trend against current (2010) percent tree cover at the province and district scales. Provinces or districts further right and lower on the scatter plot represent places that currently have both high tree cover and a high rate of tree cover loss. Jurisdictions with change trends of more than zero reflect overall net gains in percent tree cover.

Figure 18: Wall-to-wall representation of remaining tree cover as compared to historical tree cover change, by province.

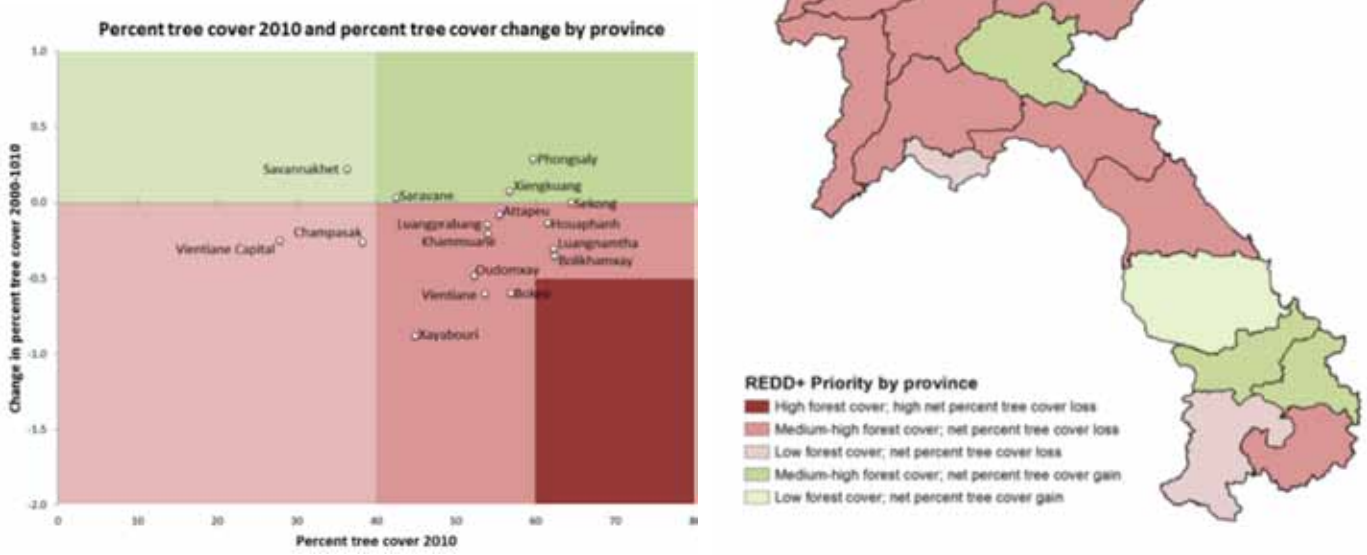
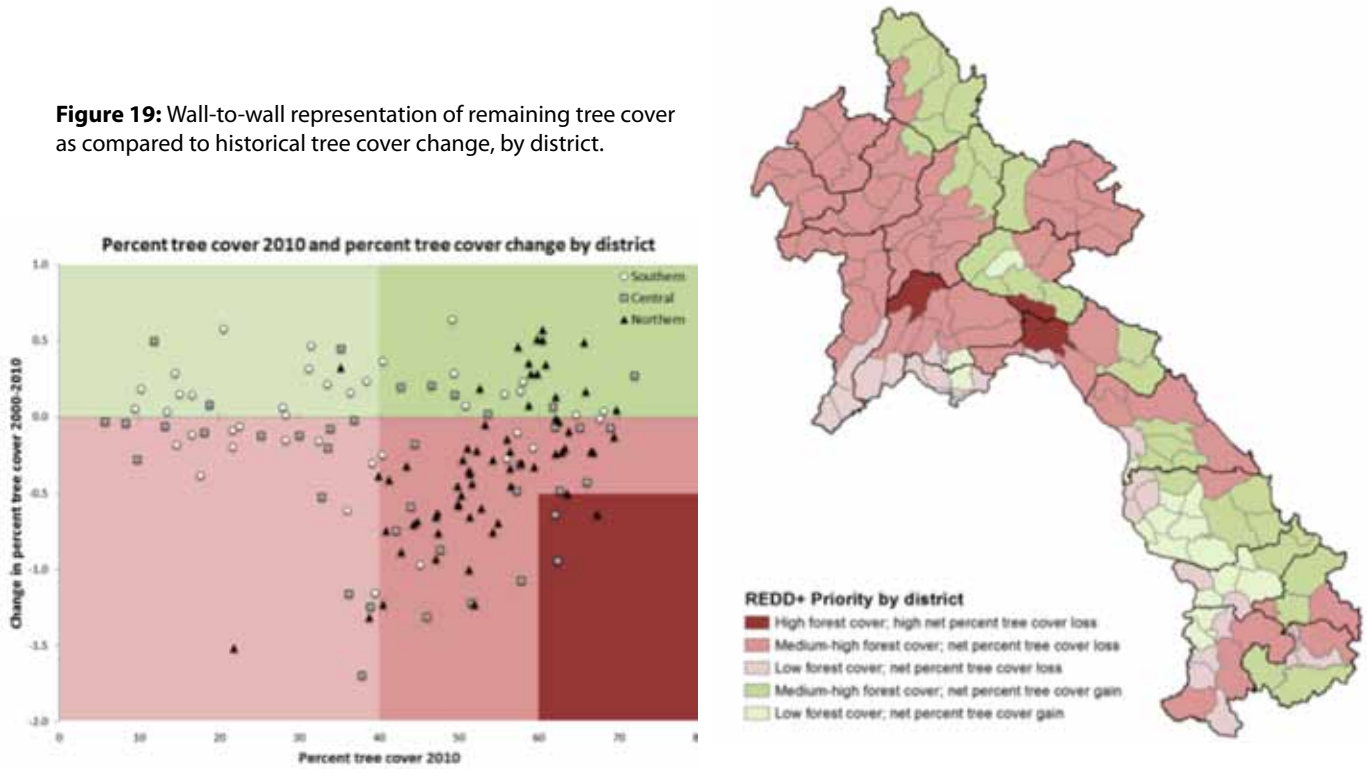


Figure 19: Wall-to-wall representation of remaining tree cover as compared to historical tree cover change, by district.



REDD+ PRIORITIES BY FOREST USE CATEGORY

Forest use categories are central to management and allocation of forested land. Lao PDR recognizes 3 forest use categories, these are: National Protected Areas (NPAs), National Production Forest Areas (PFAs) and National Protection Forest Areas (PTAs). This study also considers forest areas falling outside of National forest use categories (Non-Forest Category Areas). Similar to jurisdictional units, these areas were analyzed based on their respective average carbon stocks and 11-year historical change in percent tree cover from 2000-2010. This data is summarized in Figure 20 below.

Forest categories and non-categorized areas are individually represented in Figures 22 to Figure 27 by their respective priority colors determined in the Figure 20 scatter plot. A complete breakdown of categorical ranking including each category within each province can be found in Section VI.

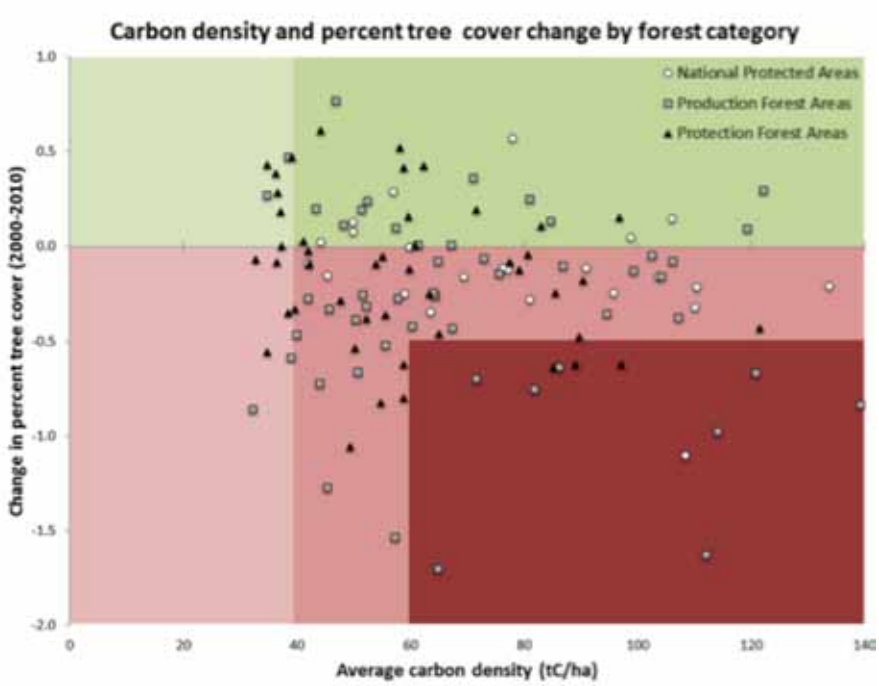


Figure 20: Carbon density and tree cover change by forest use category. See Section VI for a detailed lookup table.

A comparison of each forest use category (Figure 20) shows that Production Forest Areas (PFA) and Non-categorized forest areas are in fact the places that are most at risk of deforestation and degradation, and thus have the highest overall priority for REDD+ interventions as a category.

Comparison of Priorities by Forest Use Category

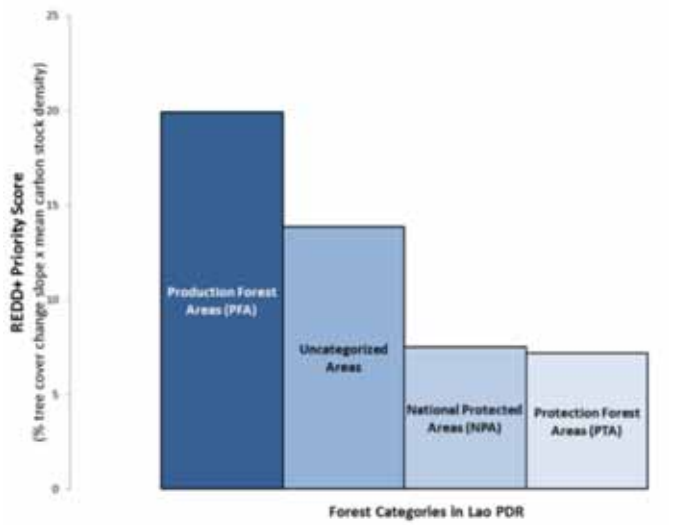


Figure 21: Relative aggregate scores of overall forest use category priority for REDD+

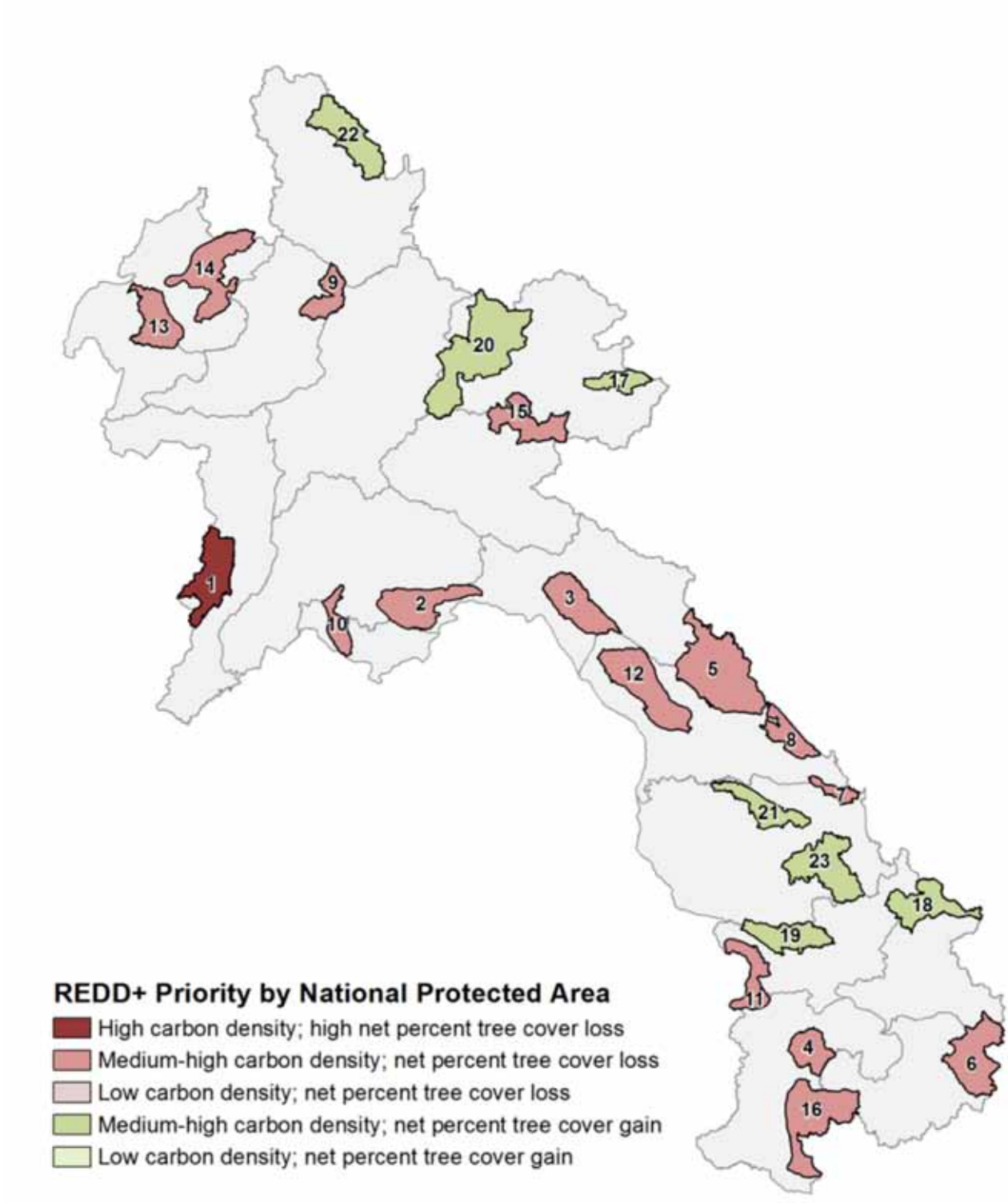


Figure 22: Rankings of REDD+ priority categorized by National Protected Area (NPA). Numbers represent relative ranking among all NPAs. Colors represent the priority of each NPA as compared to all other national forest use categories. A complete rankings table can be found in Section VI.

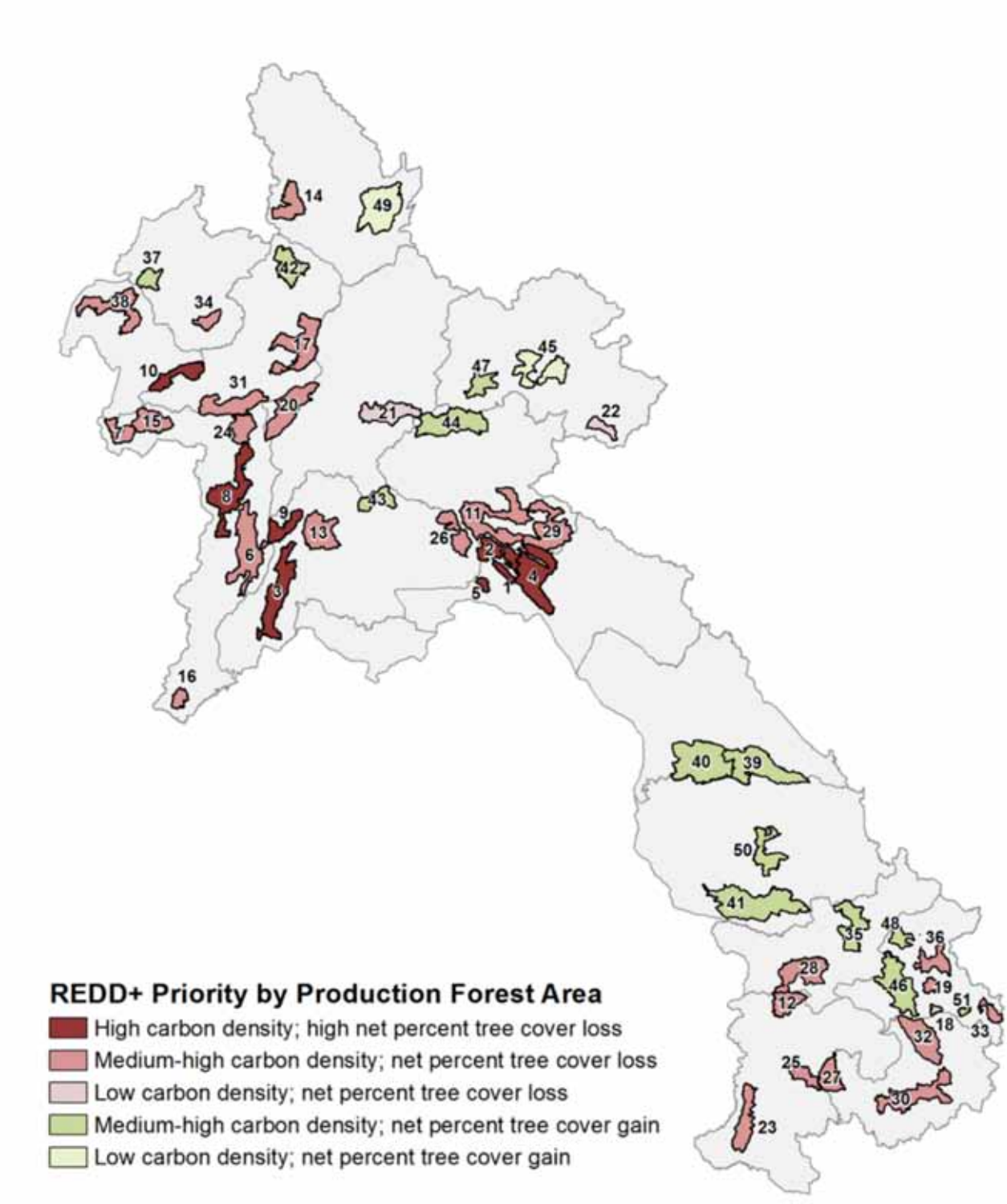


Figure 23: Rankings of REDD+ priority categorized by National Production Forest Area (PFA). Numbers represent relative ranking among all PFAs. Colors represent the priority of each PFA as compared to all other national forest use categories. A complete rankings table can be found in Section VI.

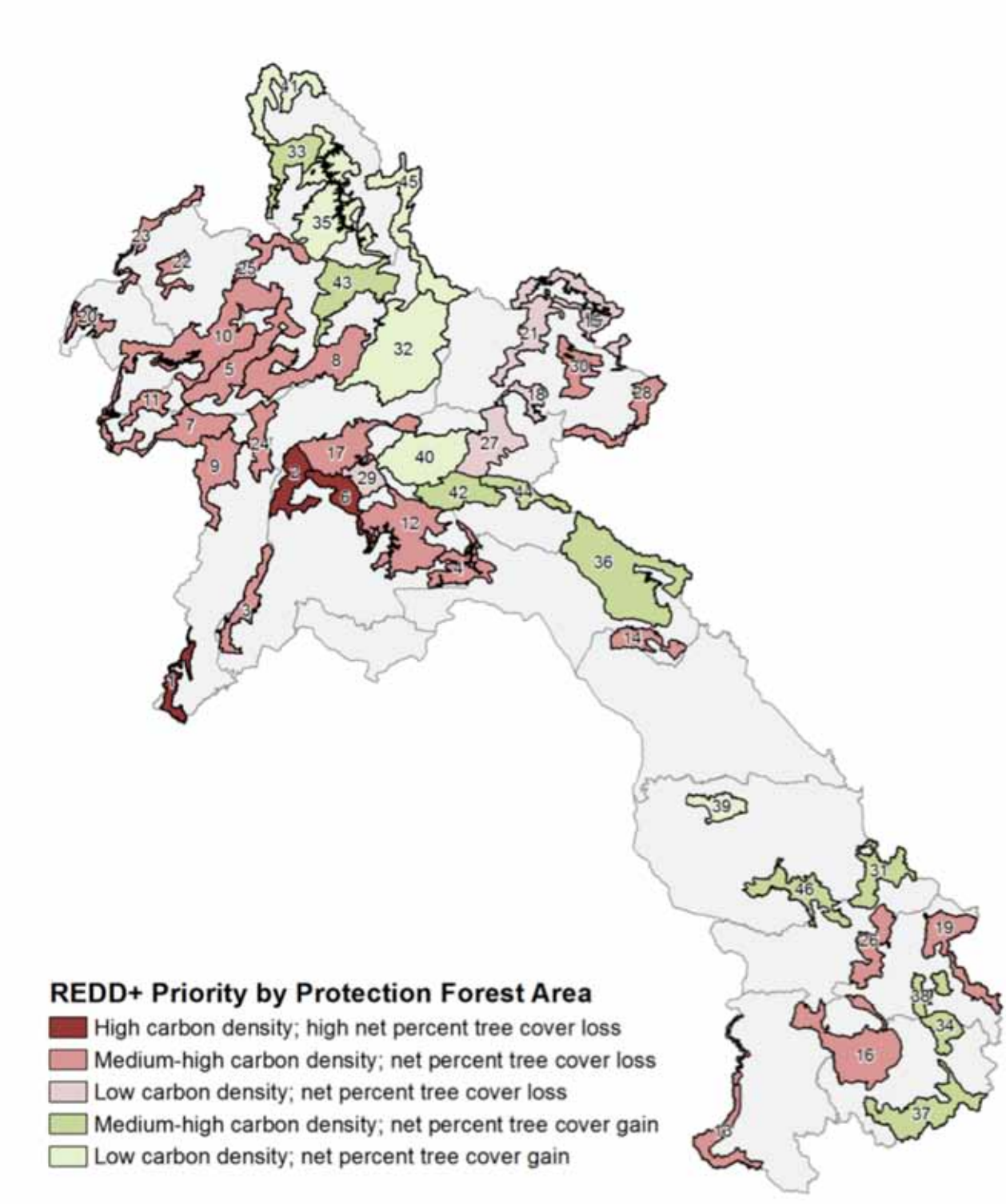


Figure 24: Rankings of REDD+ priority categorized by National Protection Forest Areas (PTA). Numbers represent relative ranking among all PTAs. Colors represent the priority of each PTA as compared to all other national forest use categories. A complete rankings table can be found in Section VI.

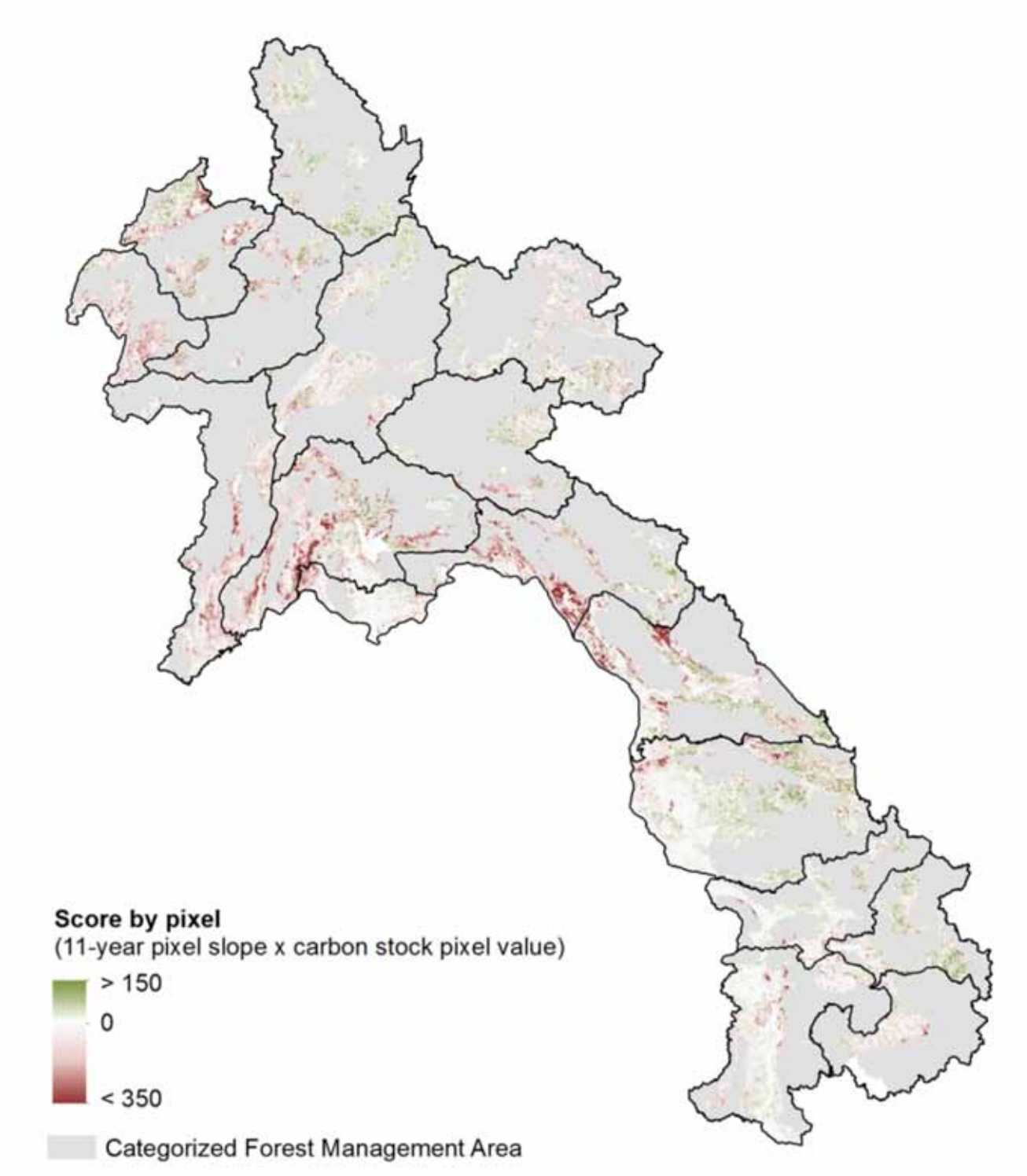


Figure 25: Breakdown of pixel-level priorities in all areas outside national forest categories (non-Production Forest Area (PFA), non-Protection Forest Area (PTA), non-National Protected Area (NPA)).

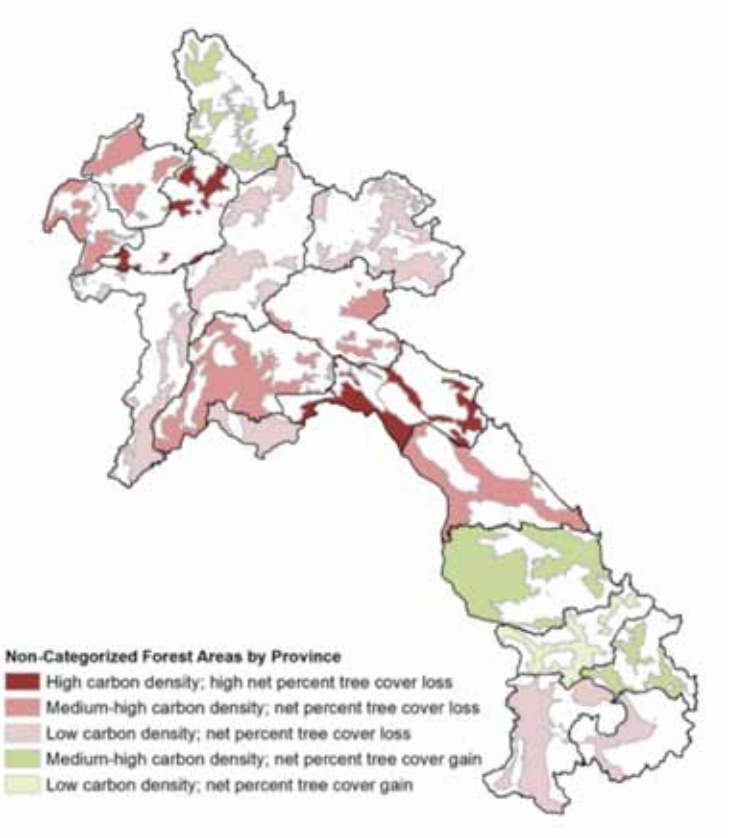


Figure 26: Breakdown of REDD+ priorities in all areas outside national forest categories (non-PFA, non-PTA, non-NPA), by province.

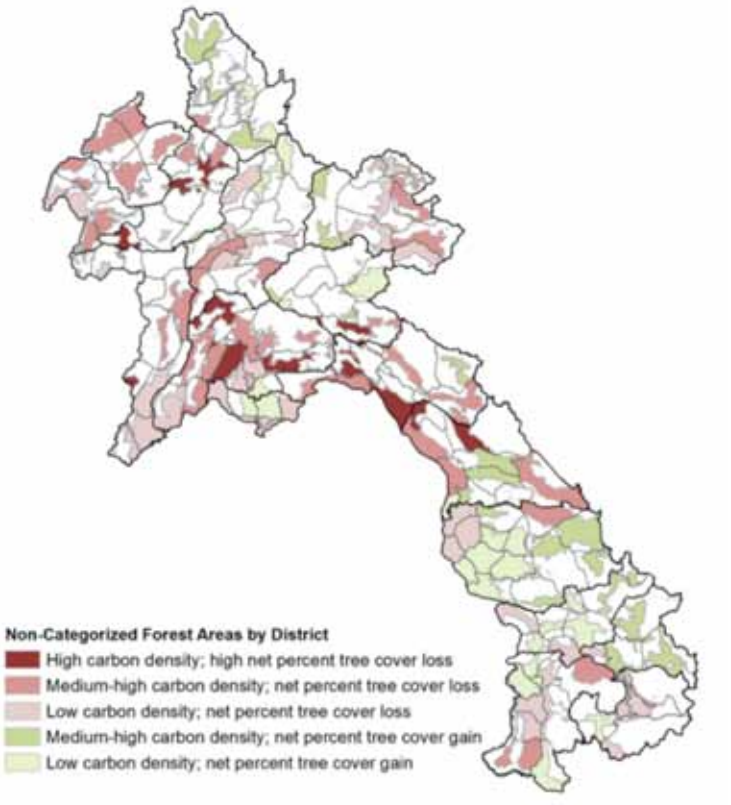
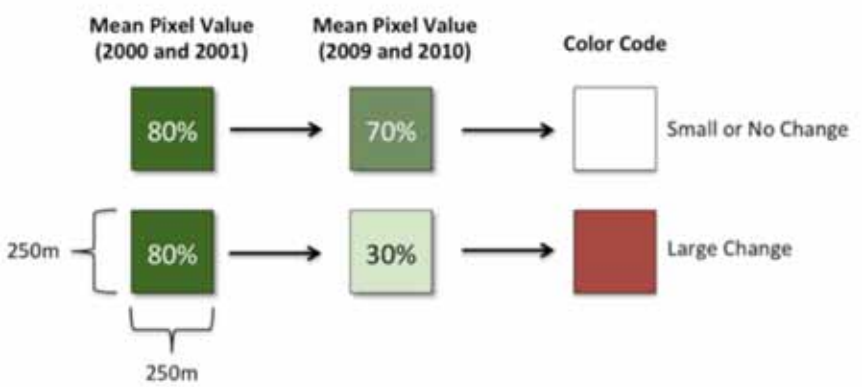


Figure 27: Breakdown of REDD+ priorities in all areas outside national forest categories (non-PFA, non-PTA, non-NPA), by district.

HOTSPOTS OF TREE COVER CHANGE

Tree cover change hotspots represent those places where we see significant loss of tree cover over a contiguous area. Below, we show a map of tree cover loss hotspots based on pixels that changed at least 30% between the mean value of 2000/2001 and the mean value of 2009/2010. These pixels were then grouped into 2km x 2km windows in order to emphasize hotspots where large areas of tree cover loss occurred.

Step 1: Identify 250m x 250m pixels with 11-year percent changes of more than 30%.



Step 2: Calculate number of large-scale pixels from Step 1 contained within 2 km x 2km pixels. Color code 2km x 2 km pixels depending on relative concentration of smaller large scale change pixels.

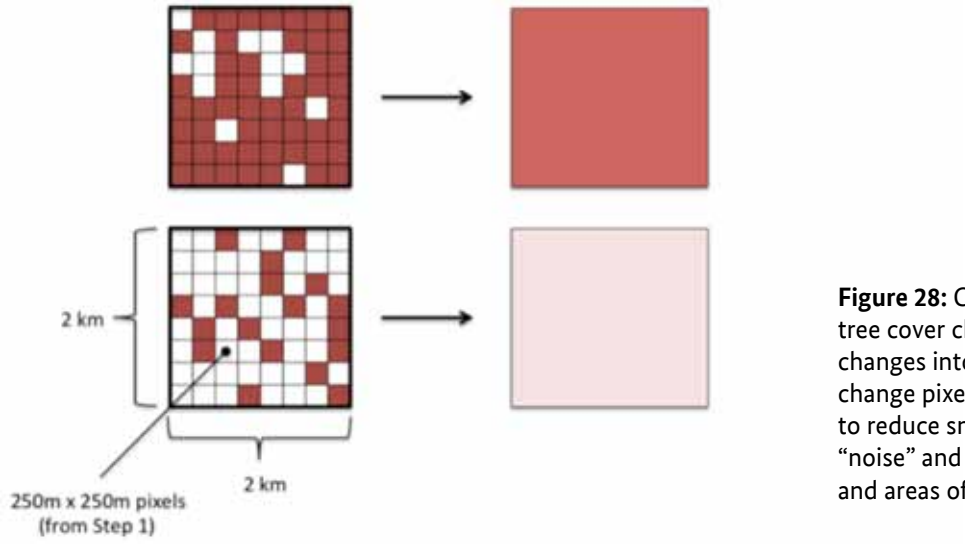


Figure 28: Conversion of percent tree cover change threshold changes into 2km x 2km forest change pixels. This is done in order to reduce small-scale change "noise" and to identify regions and areas of large-scale changes.

Tree Cover change hotspots are an important factor in understanding underlying factors behind average jurisdictional change trends. For example, the large-scale changes observable in Khammouane Province in central Lao PDR represents changes seen resulting from the construction and flooding of a reservoir by Nam Theun 2 Power Company. This change pattern does not represent normal business-as-usual historical tree cover change patterns, but rather a one-time occurrence. This skews the relative priority of Khammouane towards being a higher priority than it actually is in reality. Thus, it is important to take these large scale changes into consideration while performing more in-depth detailed studies into overall technical, political, and financial feasibility of each jurisdictional unit.

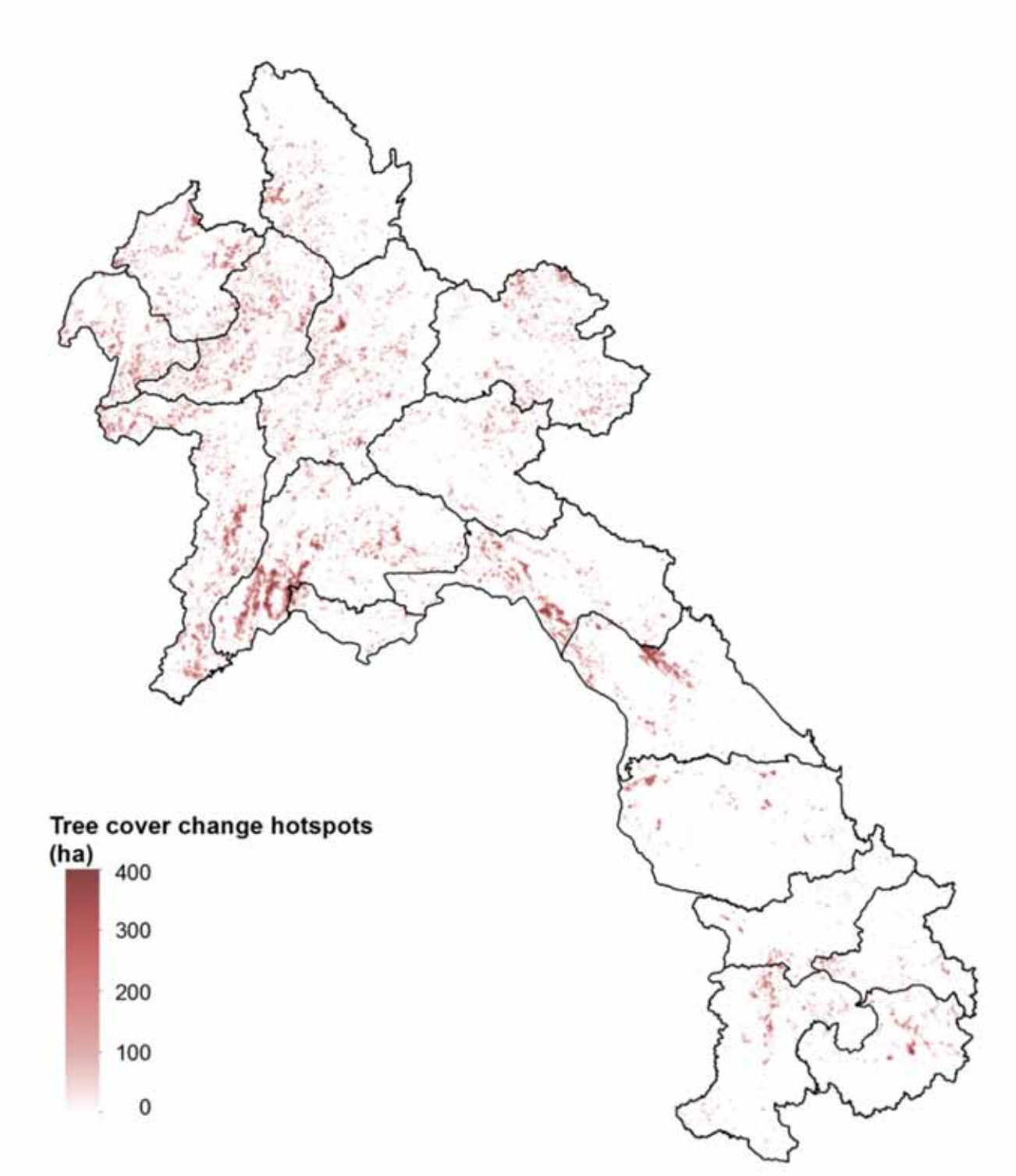


Figure 29: Map of 11-year historical percent tree cover change hotspots summarized on a 2km x 2km grid to remove smaller pockets of change and isolate larger-scale changes likely to be closely linked with deforestation.

SIX

Conclusions

FINDINGS

Priority Provincial Jurisdictions

- **Five highest priority Provinces for REDD+:** Xayabouri, Vientiane, Bolikhamxay, Oudomxay and Bokeo.
- **Five lowest priority Provinces for REDD+:** Xieng Khouang, Saravane, Sekong, Savannakhet and Phongsali.

Priority Forest Use Categories

- **Highest overall priorities for REDD+ in terms of forest use categories** are in Production Forest Areas (PFAs) and Non-Categorized Forest areas.
- **Lowest overall priorities for REDD+ in terms of forest use categories** are in National Protection Forest (NPtFAs) and National Protected Areas (NPAs).
- Within each of the national forest categories, **some individual forest management units have above average priorities and are deserving of individual study.**

LIMITATIONS

This report is limited to an analysis of average percent tree cover changes in association with a hypothesized carbon stratification map and some limitations do exist.

Second, it should be emphasized that this study reports on changes in percent tree cover from 2000-2010. Changes since 2010 are not captured in this analysis and may affect present day rankings and scoring.

CARBON STRATA

The carbon stratification of Hett et al. 2011 uses carbon values derived from UNFCCC Tier 1 values, rather than explicit ground-based measurements. Actual carbon stock densities may vary higher or lower, though it is felt that the carbon stocks reported by Hett et al 2011 are likely overly conservative. There are some concerns regarding the abrupt changes in carbon stocks resulting from overlaying FAO eco-zones on top of the MODIS base-layer index. It is felt that these abrupt changes are also unlikely to be representative of real world strata and in some cases do not correlate with visual inspections. Thus, the carbon stratification accuracy may in certain cases be biased by the overall accuracy of the FAO data.

However, as this data is used in the context of providing an analytical basis for a comparative study of change in association with overall spatial distribution of perceived carbon stocks, not to provide a specific reference level (RL) for Lao PDR, we find the data of Hett et al. 2011 to be suitable. However, an explicit validation of the accuracy of Hett et al. 2011 has not been conducted as part of this study. Such a field validation may uncover other limitations not reported here.

PERCENT TREE COVER

The tree cover change analysis in this report follows the default continuous percent tree cover data format of the VCF and does not attempt to classify the dataset in terms of forest and non-forest categories. The result is a smoother and finer detail in terms of tree cover change dynamics, potentially even picking up traces of degradation. A trade-off of this approach is the inability to report actual forest and non-forest changes in terms of total area. Other studies have successfully taken the approach of classifying VCF data into forest and non-forest layers and there is scope for such an approach in Lao PDR, however for the purposes of this report, we maintain the historical analysis of changes in percent tree cover in order to not introduce error associated with the very complex tree cover density gradients found in Lao PDR into the analysis.

SCOPE AND USE

While this report focuses on priority jurisdiction and forest use categories for REDD+, it is not intended to give an overall indication of potential. Thus, it could be seen as a resource for policymakers and donors as first point of reference before investing in more costly jurisdictional feasibility studies. Such studies must also make use of political willingness, the nature of jurisdictional drivers, perceived costs of REDD+ implementation and conservative estimates of credit flow.

SEVEN

Summary Statistics and Ranking Tables

Mean Percent Tree Cover and Carbon Look-Up Table by Province

Province	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Avg. Carbon Density (tC/ha)	11-Year Trend (%/yr)
Attapeu	62.3	60.4	62.4	59.9	57.5	61.7	61.2	64.0	63.8	62.7	55.4	57.5	-0.08
Bokeo	64.2	63.4	63.4	60.9	61.1	63.0	63.3	61.1	61.6	56.9	56.8	58.0	-0.60
Bolikhamxay	67.6	64.7	63.0	64.8	60.4	62.1	64.4	61.8	64.8	60.7	62.4	96.6	-0.35
Champasak	43.6	41.8	45.3	40.3	40.1	41.7	43.8	45.9	41.1	40.9	38.2	43.4	-0.26
Houaphanh	64.1	64.8	62.2	60.1	61.8	62.7	59.8	62.4	65.1	61.6	61.5	41.1	-0.14
Khammuane	58.9	53.6	55.6	55.8	54.6	54.0	57.6	56.3	55.2	53.5	53.9	81.7	-0.21
Luangnamtha	66.9	65.5	66.3	64.8	65.0	67.9	67.4	65.7	64.1	63.6	62.2	63.7	-0.30
Luangprabang	57.3	59.2	58.2	55.1	54.0	57.5	58.0	57.1	63.1	53.8	53.9	43.3	-0.14
Oudomxay	59.4	60.5	58.1	55.2	55.2	59.2	61.0	57.0	59.5	52.9	52.3	65.0	-0.48
Phongsaly	60.6	62.0	61.6	56.9	57.8	64.9	64.8	62.7	64.2	64.6	59.7	42.1	0.29
Saravane	45.4	42.5	45.5	45.8	40.7	42.0	46.9	47.8	45.3	44.8	42.4	52.5	0.04
Savannakhet	37.1	32.6	33.2	34.2	32.5	32.9	38.6	38.3	35.5	34.5	36.3	53.2	0.22
Sekong	67.5	64.9	66.5	65.7	65.0	67.1	64.5	65.9	67.5	68.1	64.4	70.7	0.00
Vientiane	61.1	59.8	59.4	56.7	56.3	56.1	60.0	55.1	58.9	53.1	53.5	72.9	-0.60
Vientiane Capital	35.5	28.8	27.6	26.1	25.9	27.5	32.6	26.3	30.0	27.9	27.8	32.5	-0.25
Xayabouri	55.8	53.9	55.6	50.2	51.0	50.2	52.4	49.6	53.1	45.4	44.9	64.4	-0.88
Xiengkuang	55.3	57.5	56.5	56.3	54.6	56.2	57.9	56.7	59.7	54.6	56.6	56.5	0.08

Mean Percent Tree Cover and Carbon Look-Up Table by Province and District

Province	District	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Carbon Density (tC/ha)	11-Year Trend (%/yr)
Attapeu	Phouvong	72.3	68.2	70.9	69.3	66.7	71.7	71.7	73.0	73.1	73.3	64.7	58.4	0.02
	Samakhixai	36.8	37.0	39.2	36.3	29.4	35.3	36.7	40.1	38.2	35.2	32.5	41.5	-0.16
	Sanamxai	54.4	54.1	55.3	53.7	50.9	55.6	54.6	58.5	57.8	55.5	50.8	49.9	0.08
	Xaixettha	47.2	47.4	50.4	45.9	40.5	47.4	45.6	51.3	48.4	46.7	39.1	47.5	-0.30
	Xanxai	67.7	65.9	67.4	64.0	64.3	65.5	65.1	67.2	68.9	67.9	59.3	70.0	-0.20
Bokeo	Houyxay	62.0	60.9	62.1	59.5	56.6	60.2	60.0	58.0	57.2	54.1	54.9	56.9	-0.70
	Meung	71.8	71.5	73.0	70.2	70.9	72.7	74.3	73.0	71.3	70.0	69.4	63.8	-0.13
	Paktha	58.7	58.5	56.1	53.7	57.6	56.2	57.1	54.0	56.3	47.3	47.0	45.9	-0.93
	PhaOudom	65.0	63.7	60.9	60.6	62.4	62.9	62.6	59.3	63.0	55.5	54.2	63.8	-0.75
	Thonpheung	58.4	57.1	60.9	54.4	52.4	57.0	57.0	55.9	54.2	50.9	52.8	49.7	-0.60
Bolikhamxay	Bolikhan	71.7	69.3	67.2	69.4	60.0	66.4	64.6	62.7	65.0	58.9	62.3	123.0	-0.95
	Khamkeut	64.0	62.2	59.9	60.2	57.8	60.5	63.8	61.0	63.4	62.2	61.8	77.0	0.06
	Pakkading	67.2	60.3	56.8	59.8	52.8	52.9	56.7	52.7	54.6	50.5	51.6	92.5	-1.22
	Pakxan	41.6	31.8	30.2	33.3	28.4	27.5	32.6	29.3	31.3	28.3	32.9	43.0	-0.53
	Thaphabat	63.4	58.9	54.9	57.1	55.3	52.9	58.4	53.4	58.0	51.9	57.3	100.6	-0.49
	Viangthong	71.2	70.0	70.0	72.5	68.3	70.6	71.1	69.8	74.6	67.8	69.0	112.7	-0.07
	Xaichamphon	70.6	69.2	69.3	69.3	68.4	67.7	72.4	69.6	71.4	72.1	72.0	74.0	0.27
Champasak	Bachiangchaleunsouk	51.4	45.1	48.4	42.5	42.7	41.4	41.3	40.0	39.5	36.5	39.5	36.8	-1.16
	Champasak	27.2	26.6	28.1	26.2	24.0	23.8	28.1	31.8	25.3	26.3	21.7	35.0	-0.20
	Khong	23.5	28.0	29.7	26.7	25.4	28.5	27.6	34.7	25.9	26.2	21.7	30.1	-0.09
	Mounlapamok	45.6	43.9	47.3	39.1	41.4	43.4	46.0	49.5	43.1	40.3	40.4	50.0	-0.25
	Pakxe	17.4	15.9	16.7	15.3	15.4	17.9	18.7	18.1	17.7	17.9	16.6	17.8	0.14
	Pakxong	58.0	53.9	60.5	52.8	54.9	55.2	57.4	56.2	53.2	55.0	51.4	46.7	-0.38
	Pathoumphon	63.4	59.6	62.8	60.4	57.2	62.6	62.5	63.1	61.0	59.9	56.0	60.8	-0.27
	Phonthong	10.9	11.4	12.0	10.8	9.6	9.8	12.9	16.4	12.0	13.7	10.2	24.7	0.18
	Soukhouma	19.5	22.4	24.0	19.1	18.6	17.3	23.5	30.2	20.0	18.9	16.6	35.3	-0.12

Province	District	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Carbon Density (tC/ha)	11-Year Trend (%/yr)
	Xanasomboun	30.9	28.7	31.8	27.5	25.7	26.7	32.1	35.1	29.9	30.2	27.9	31.6	0.06
Houapanh	Et	61.4	57.1	53.7	54.2	55.3	55.0	53.1	57.0	58.0	49.8	47.3	31.6	-0.76
	Houamouang	64.2	66.6	62.3	60.0	65.3	64.1	59.0	61.6	66.2	62.5	63.7	36.6	-0.09
	Kouan	62.3	65.3	63.3	61.1	57.8	63.8	61.8	59.9	65.3	62.3	62.4	39.4	-0.03
	Sopbao	58.7	57.4	56.6	53.8	54.8	53.6	50.6	56.7	57.0	53.6	51.6	40.6	-0.43
	Viangthong	66.8	67.0	66.5	62.6	66.8	68.2	65.2	69.0	70.5	67.1	65.9	48.7	0.17
	Viangxai	63.2	64.6	60.2	60.7	58.9	61.1	59.4	61.0	63.0	57.1	62.1	39.9	-0.24
	Xam Tai	67.9	71.1	67.5	64.6	63.4	65.3	64.5	63.4	66.6	67.1	66.8	43.1	-0.23
	Xamnua	64.4	64.2	61.1	60.0	63.0	63.2	59.0	61.8	66.6	62.9	62.0	41.0	-0.01
	Xiangkho	55.9	52.0	51.9	49.2	49.3	46.7	45.3	55.5	51.2	45.5	44.8	32.5	-0.68
Khammuane	Boualapha	69.9	62.0	64.4	64.2	63.9	64.0	68.1	64.6	64.8	64.5	65.1	101.5	-0.07
	Gnommalat	53.9	49.6	52.5	56.9	56.2	53.2	53.5	54.4	54.9	50.5	53.6	77.5	0.02
	Hinboun	53.6	44.7	47.1	44.9	42.6	41.9	47.2	45.1	43.3	40.0	42.2	56.5	-0.75
	Khounkham	54.2	47.4	44.5	47.3	39.7	42.6	47.1	43.5	45.2	43.4	44.0	59.4	-0.59
	Mahaxai	47.9	45.0	45.2	48.1	47.6	45.2	51.2	52.2	49.1	46.4	46.6	71.0	0.21
	Nakay	72.2	69.5	72.1	70.4	69.8	69.5	70.9	69.5	69.1	67.9	66.0	99.8	-0.43
	Nongbok	9.8	7.5	8.8	7.9	8.8	8.8	12.7	12.8	12.5	12.4	11.9	16.1	0.50
	Thakhek	37.4	30.2	31.8	33.8	32.4	30.8	36.8	37.5	31.0	30.1	33.9	49.5	-0.08
	Xaibouathong	51.0	48.3	49.2	52.4	50.4	49.2	54.5	52.3	52.2	50.8	49.5	100.7	0.14
	Xebangfai	45.5	39.0	43.8	40.9	40.8	40.8	46.9	49.1	43.5	42.3	42.8	66.7	0.19
Luangnamtha	Long	66.7	64.1	67.3	66.8	66.9	69.7	67.9	67.5	63.8	64.7	62.8	56.0	-0.23
	Louangnamtha	70.7	69.2	69.5	66.5	67.4	70.3	70.6	66.5	66.1	66.2	63.5	62.7	-0.50
	Nale	68.4	68.5	64.6	64.2	65.4	66.7	68.9	67.8	66.7	65.2	63.2	67.6	-0.20
	Sing	50.8	53.6	55.5	51.8	49.0	55.9	53.0	51.1	47.5	48.2	51.3	48.5	-0.37
	Viangphoukha	72.4	68.7	70.1	69.7	70.3	71.6	71.7	70.5	71.1	68.5	66.5	82.5	-0.22
Luangprabang	Champhet	48.9	50.2	48.1	46.3	42.7	48.2	50.2	48.9	52.6	41.7	43.4	50.1	-0.32
	Louangphabang	46.2	46.8	48.8	44.5	35.6	45.6	48.1	46.7	48.6	37.6	41.2	41.7	-0.41

Province	District	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Carbon Density (tC/ha)	11-Year Trend (%/yr)
	Nambak	56.8	58.5	53.1	52.4	53.7	54.3	58.9	51.4	61.0	52.0	50.5	43.9	-0.28
	Nan	53.8	54.5	57.8	52.3	54.2	54.1	52.7	53.5	57.0	45.3	50.3	71.6	-0.51
	Ngoy	61.2	62.7	58.2	55.9	56.9	62.0	62.1	59.0	70.4	60.4	59.7	39.8	0.29
	Pak Ou	51.0	55.3	51.4	47.7	43.2	49.0	52.5	47.3	55.3	42.5	40.8	37.1	-0.74
	Pakxeng	58.7	60.5	59.7	56.5	55.3	57.7	57.2	60.1	67.4	54.6	52.2	33.9	-0.22
	Phonthong	64.2	63.9	61.2	59.9	57.8	66.7	65.2	61.5	70.9	66.0	65.6	41.6	0.49
	Phonxai	59.6	63.6	64.1	61.6	57.8	61.8	59.9	63.3	66.0	58.5	56.4	39.1	-0.23
	Phoukhoun	54.6	56.4	59.4	54.7	54.9	54.7	55.8	56.4	56.9	50.1	54.1	41.9	-0.28
	Viangkham	61.1	64.6	62.4	58.3	60.5	61.5	61.8	63.0	69.7	61.6	58.7	37.5	0.08
	Xiang Ngeun	55.3	56.5	59.2	53.9	52.9	55.4	56.2	56.5	61.0	48.5	51.2	48.1	-0.35
Oudomxay	Beng	59.4	59.8	58.5	54.9	55.4	59.0	60.7	56.1	57.3	50.9	51.3	75.3	-0.65
	Houn	52.2	54.4	52.7	48.6	49.5	51.6	52.6	51.4	52.4	43.0	44.3	62.7	-0.70
	La	66.0	65.7	63.9	60.2	62.1	66.3	70.4	65.0	68.3	66.5	62.0	63.5	0.13
	Na Mo	65.1	65.7	61.5	58.8	61.0	66.1	66.6	59.8	63.3	60.9	56.5	52.8	-0.45
	Nga	61.0	63.1	60.4	58.4	57.1	61.6	63.8	59.2	63.9	55.1	56.4	58.6	-0.33
	Pakbeng	56.3	57.8	55.2	53.7	55.0	55.2	55.2	56.3	57.0	47.3	49.8	59.7	-0.58
	Xai	58.5	59.5	57.0	54.2	50.8	57.9	60.5	54.8	57.5	51.7	49.8	77.8	-0.57
Phongsaly	BounNua	62.7	63.4	62.9	58.4	61.0	65.1	64.4	62.3	61.5	59.6	57.8	41.8	-0.30
	Boun Tai	64.5	65.3	65.8	61.7	58.8	68.1	67.7	64.2	63.3	61.2	59.4	45.5	-0.32
	GnotOu	57.1	59.7	60.5	57.3	58.5	63.5	62.8	63.9	60.0	63.4	58.8	38.9	0.35
	Khao	60.7	60.1	58.6	51.8	57.7	62.0	65.3	59.6	66.0	64.8	60.5	49.6	0.57
	Mai	59.2	60.2	58.5	53.2	55.0	62.5	62.6	57.1	64.6	64.2	60.4	37.3	0.50
	Phongsali	62.4	65.0	65.6	60.8	60.9	68.2	68.4	68.6	68.0	68.9	60.9	44.5	0.35
	Samphan	61.6	62.5	61.4	56.6	55.1	65.6	64.3	62.8	65.1	65.4	59.0	42.4	0.29
Saravane	Khongxedon	32.2	28.5	32.4	31.4	26.9	26.4	33.3	34.1	30.4	32.2	28.3	33.2	0.01
	Lao Ngam	45.1	41.3	43.2	44.0	37.7	39.4	44.7	42.5	39.0	37.9	36.0	30.1	-0.61
	Nakhonpheng	33.2	29.5	31.0	30.2	27.4	27.4	34.5	32.7	30.2	29.0	28.3	38.4	-0.16

Province	District	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Carbon Density (tC/ha)	11-Year Trend (%/yr)
	Salavan	39.3	35.9	40.3	40.3	32.6	37.5	41.1	44.6	38.9	40.7	36.4	43.2	0.16
	Samouay	55.9	55.5	59.0	59.8	59.5	56.3	61.8	53.5	61.8	58.3	57.8	78.1	0.17
	Ta Oy	64.6	62.3	63.6	65.4	61.7	62.9	64.5	66.2	65.6	63.6	62.1	84.5	0.03
	Toumlan	31.4	28.0	33.5	34.5	25.5	26.6	34.2	41.4	34.6	34.4	31.5	40.3	0.47
	Vapi	39.3	37.2	41.7	40.5	34.7	34.6	42.7	43.9	41.7	41.2	38.4	40.1	0.24
Savannakhet	Atsaphangthong	15.1	7.8	8.5	7.7	7.6	8.0	13.7	13.0	9.0	11.9	14.5	30.2	0.29
	Atsaphon	41.1	35.6	36.3	37.0	36.8	34.8	42.8	42.5	38.9	40.3	40.4	55.8	0.37
	Champhon	16.1	12.3	13.2	12.8	11.2	10.4	16.0	17.9	15.1	12.4	15.1	19.4	0.15
	KaysonePhomvihane	26.3	22.4	24.8	21.1	22.3	21.8	25.9	27.5	26.6	19.9	22.6	28.1	-0.06
	Nong	57.8	54.8	55.5	56.6	54.5	55.6	58.6	58.2	58.9	56.5	58.0	71.1	0.23
	Outhoumphon	19.9	15.2	16.0	15.4	14.3	13.4	19.2	20.0	15.1	13.8	14.6	27.3	-0.19
	Phalanxai	37.0	28.8	29.3	30.0	30.6	29.6	37.7	34.5	31.7	33.4	33.5	50.5	0.22
	Phin	44.8	40.4	42.1	43.9	40.7	42.9	48.1	50.1	45.6	45.0	49.2	66.2	0.64
	Songkhon	10.3	9.0	8.6	8.8	7.8	6.8	12.2	13.4	9.3	7.5	9.5	27.4	0.05
	Thapangthong	33.5	29.0	27.8	29.3	27.7	27.7	35.3	37.8	34.4	29.4	31.3	48.9	0.32
	Vilabouli	62.3	56.3	56.4	58.9	55.8	57.3	61.1	56.3	56.8	59.2	57.4	96.5	-0.10
	Xaibouli	25.6	20.9	25.1	23.2	22.1	21.9	28.4	26.8	21.3	19.7	17.7	31.0	-0.39
	Xaiphouthong	15.9	11.6	12.1	10.8	11.6	10.5	16.2	16.2	13.7	10.5	13.5	31.1	0.03
	Xepon	56.1	52.5	51.8	55.0	52.3	54.1	58.3	53.1	54.1	54.7	55.7	75.1	0.15
	Xonbouli	17.2	12.6	13.3	15.3	12.4	12.8	21.2	23.7	16.7	15.2	20.6	32.9	0.58
Sekong	Dakchung	70.2	69.1	69.4	67.1	71.2	71.4	65.8	67.8	69.7	72.6	67.6	74.5	-0.01
	Lamam	52.8	49.3	54.4	53.5	45.6	53.7	51.9	57.1	57.9	55.4	49.4	55.8	0.29
	Kalum	74.8	71.3	72.6	73.5	72.7	73.1	72.2	71.7	74.5	74.5	72.8	80.4	0.04
	Thateng	55.3	53.7	53.2	51.1	48.1	51.2	51.3	48.6	44.9	46.4	45.1	40.6	-0.97
Vientiane	Fuang	61.6	59.6	57.3	53.5	52.4	53.0	55.6	47.3	51.9	49.3	46.0	53.0	-1.32
	Hinheup	58.4	55.2	53.4	48.9	49.6	50.0	55.1	46.2	50.4	47.0	47.6	69.3	-0.87
	Hom	69.2	67.1	66.4	67.8	63.3	65.7	69.0	65.1	68.5	60.4	62.7	102.2	-0.48

Province	District	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Carbon Density (tC/ha)	11-Year Trend (%/yr)
	Kasi	68.8	67.3	68.3	66.8	66.8	65.4	67.4	65.0	65.9	60.6	62.1	86.5	-0.64
	KeoOudom	50.6	47.4	45.8	42.6	41.8	45.8	48.9	42.8	51.1	44.2	44.5	30.7	-0.18
	Met	71.8	67.1	68.4	63.0	64.9	62.1	66.5	61.1	65.4	57.7	57.8	57.8	-1.08
	Mun	57.9	55.4	53.3	48.1	47.2	46.1	48.4	43.4	47.3	40.2	37.9	50.0	-1.70
	Phonhong	38.4	29.4	31.3	27.2	26.8	31.3	33.9	28.1	31.5	27.5	33.6	39.3	-0.20
	Thoulakhom	34.1	31.0	27.5	27.2	27.8	27.3	34.3	30.8	36.0	31.9	35.3	45.2	0.45
	Vangviang	63.1	62.3	61.2	60.4	58.7	59.5	64.1	58.2	62.1	59.3	57.7	102.3	-0.32
	Viangkham	28.6	23.0	21.4	19.1	19.2	21.7	22.8	19.1	25.6	19.7	25.3	19.4	-0.13
	Xaisomboun	62.5	64.4	65.3	62.2	63.0	63.2	67.3	63.3	67.0	60.2	62.1	85.7	-0.07
	Xanakham	53.6	54.9	53.0	48.0	47.7	44.1	50.2	43.7	48.8	43.6	38.9	41.8	-1.25
Vientiane Capital	Chanthabouli	7.7	4.7	4.2	5.5	5.3	4.5	6.4	6.3	5.0	5.1	5.7	2.4	-0.03
	Hatxayfong	18.0	12.3	11.9	12.2	13.6	13.5	17.5	11.8	14.7	13.6	13.3	11.7	-0.06
	Naxaythong	43.9	36.5	35.0	33.3	33.7	37.8	41.3	36.4	40.7	36.9	36.9	45.8	-0.02
	Pak Ngum	36.8	27.9	27.9	27.9	25.7	26.0	35.1	27.3	30.5	29.0	30.0	41.1	-0.13
	Sangthong	50.9	46.8	44.0	39.4	38.6	41.2	43.1	35.7	39.9	36.9	36.2	37.7	-1.16
	Sikhottabong	24.8	20.3	17.1	16.4	19.1	15.7	22.7	20.1	21.0	20.1	18.1	18.5	-0.10
	Sisattanak	10.6	6.3	4.8	5.8	7.2	7.7	8.2	6.4	6.9	6.0	8.4	1.3	-0.04
	Xaithani	23.9	16.2	15.8	14.7	15.2	15.6	22.7	15.5	19.9	19.3	18.8	20.1	0.08
	Xaixettha	16.1	10.2	9.4	10.4	10.6	11.0	13.9	9.2	9.9	9.9	9.8	10.3	-0.28
Xayabouri	Boten	48.5	44.0	47.8	38.9	36.8	36.8	46.6	43.7	41.4	44.1	39.8	54.9	-0.39
	Hongsa	57.1	58.7	55.2	53.9	54.2	57.5	56.2	57.2	65.3	51.0	51.0	86.9	-0.20
	Kenthao	38.7	38.9	37.6	29.5	28.9	28.0	30.2	28.4	25.2	27.9	21.8	35.1	-1.51
	Khop	55.8	55.0	55.4	51.7	55.0	52.6	50.7	55.7	52.4	41.7	40.5	45.3	-1.23
	Ngeun	53.0	55.6	54.1	53.3	55.1	54.2	52.4	52.2	56.2	43.7	42.8	60.6	-0.89
	Paklay	55.3	52.1	54.0	46.5	47.4	43.7	48.9	43.0	46.8	43.6	38.7	45.5	-1.31
	Phiang	65.0	60.8	65.2	58.8	59.6	57.4	61.0	53.0	59.3	50.5	51.9	86.1	-1.23
	Thongmixai	66.1	58.1	64.1	54.9	54.8	51.5	61.2	53.9	57.9	52.8	51.2	107.6	-1.00

Province	District	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Carbon Density (tC/ha)	11-Year Trend (%/yr)
	Xaignabouli	53.6	53.5	56.4	51.3	52.6	53.4	52.7	50.4	56.6	46.0	49.8	53.1	-0.45
	Xaisathan	53.0	53.4	52.8	48.1	53.2	51.9	52.0	54.0	56.0	37.8	47.1	77.0	-0.65
	Xianghon	58.4	56.0	56.8	55.4	56.0	57.2	55.5	57.5	58.4	50.5	47.3	48.1	-0.63
Xiengkuang	Kham	57.6	60.2	58.3	57.3	57.9	56.1	58.6	57.6	60.3	56.4	56.0	41.1	-0.14
	Khoun	50.9	54.1	53.4	53.6	52.7	54.2	58.8	53.8	59.7	52.4	57.4	44.6	0.46
	Mok	69.2	68.7	68.2	70.1	66.8	69.7	69.9	67.9	72.8	66.1	69.7	96.5	0.05
	Nonghet	52.6	56.0	52.8	53.0	50.0	51.2	52.2	52.1	57.4	50.4	53.2	40.3	-0.05
	Pek	32.2	33.0	32.3	31.5	32.8	31.7	37.6	34.2	35.1	33.5	35.1	27.1	0.32
	Phaxai	49.6	54.5	58.3	55.8	53.1	55.3	59.6	56.2	58.0	54.3	59.7	49.4	0.51
	Phoukout	51.2	55.3	53.3	52.1	52.9	54.8	54.8	57.1	57.5	52.7	52.5	43.9	0.19
	Thathom	74.7	72.7	73.1	73.9	65.2	72.2	70.2	70.1	70.6	67.0	67.3	121.6	-0.64

REDD+ Priority Scoring by Province and District

Provincial Rank	Province	District Rank	District	Score
1	**Xayabouri**	1	Thongmixai	-107.6
		2	Phiang	-95.9
		3	Paklay	-62.3
		4	Kenthao	-57.2
		5	Khop	-55.8
		6	Xaisathan	-51.8
		7	Ngeun	-49.5
		8	Xianghon	-28.5
		9	Xaignabouli	-26.4
		10	Boten	-25.3
		11	Hongsa	-15.0
2	**Vientiane**	1	Mun	-102.8
		2	Fuang	-76.6
		3	Hinheup	-74.4
		4	Met	-63.2
		5	Xanakham	-61.1
		6	Hom	-56.8
		7	Kasi	-54.3
		8	Vangviang	-38.0
		9	Xaisomboun	-20.5
		10	Phonhong	-18.5
		11	Keo_Oudom	-14.7
		12	Thoulakhom	14.4
3	**Bolikhamxay**	1	Pakkading	-131.3
		2	Bolikhan	-117.4
		3	Thaphabat	-61.7
		4	Pakxan	-51.0
		5	Khamkeut	2.2
		6	Xaichamphon	13.6
4	**Oudomxay**	1	Beng	-49.4
		2	Houn	-45.4
		3	Xai	-42.2
		4	Pakbeng	-34.6
		5	Na_Mo	-24.3
		6	Nga	-21.9
		7	La	4.6
5	**Bokeo**	1	Paktha	-46.3
		2	Pha_Oudom	-42.5
		3	Houyxay	-32.7

Provincial Rank	Province	District Rank	District	Score
		4	Thonpheung	-21.4
		5	Meung	-4.7
6	Khammuane	1	Hinboun	-56.1
		2	Nakay	-49.4
		3	Khounkham	-40.6
		4	Thakhek	-20.1
		5	Boualapha	-8.3
		6	Xaibouathong	-6.1
		7	Xebangfai	-4.4
		8	Gnommalat	-0.1
		9	Mahaxai	6.7
		10	Nongbok	11.0
7	LuangNamtha	1	Louangnamtha	-29.9
		2	Sing	-23.7
		3	Viangphoukha	-16.7
		4	Long	-16.6
		5	Nale	-13.9
8	Vientiane Capital	1	Sangthong	-59.5
		2	Pak_Ngum	-24.8
		3	Xaixettha	-10.5
		3	Xaixettha	-10.5
		5	Hatxayfong	-10.3
		6	Naxaythong	-6.6
		7	Sikhottabong	-3.5
		8	Chanthabouli	0.0
		9	Sisattanak	0.1
		10	Xaithani	0.7
9	Champassak	1	Bachiangchaleunsouk	-49.6
		2	Champasak	-17.1
		3	Mounlapamok	-17.1
		4	Pathoumphon	-16.5
		5	Pakxong	-11.4
		6	Soukhouma	-9.1
		7	Khong	-7.4
		8	Xanasomboun	-3.4
		9	Pakxe	-0.1
10	Luang Prabang	1	Nan	-39.9
		2	Pak_Ou	-30.4
		3	Xiang_Ngeun	-18.5
		4	Louangphabang	-16.8
		5	Champhet	-16.7

Provincial Rank	Province	District Rank	District	Score
		6	Phoukhoun	-16.0
		7	Nambak	-11.1
		8	Phonxai	-8.6
		9	Pakxeng	-8.4
		10	Viangkham	2.1
		11	Ngoy	9.7
		12	Phonthong	19.4
11	**Attapeu**	1	Xanxai	-13.6
		2	Samakhixai	-10.7
		3	Sanamxai	-3.2
		4	Phouvong	0.2
12	**Houaphan**	1	Et	-22.7
		2	Xiangkho	-20.2
		3	Sopbao	-16.9
		4	Viangxai	-12.2
		5	Xam-Tai	-10.3
		6	Houamouang	-2.5
		7	Kouan	-2.2
		8	Xamnua	-1.5
		9	Viangthong	8.2
13	**Xiengkhouang**	1	Thathom	-70.7
		2	Kham	-6.4
		3	Mok	-6.0
		4	Nonghet	-3.1
		5	Phoukout	8.0
		6	Pek	9.8
		7	Khoun	10.0
		8	Phaxai	17.5
14	**Saravane**	1	Lao_Ngam	-25.6
		2	Nakhonpheng	-11.2
		3	Khongxedon	-5.4
		4	Ta Oy	-2.1
		5	Salavan	0.2
		6	Vapi	5.9
		7	Samouay	8.8
		8	Toumlan	14.9
15	**Sekong**	1	Thateng	-28.8
		2	Dakchung	-6.5
		3	Kalum	1.9
		4	Lamam	12.8
16	**Savannakhet**	1	Xaibouli	-22.2
		2	Vilabouli	-18.0

Provincial Rank	Province	District Rank	District	Score
		3	Outhoumphon	-11.7
		4	KaysonePhomviha ne	-3.9
		5	Champhon	-0.3
		6	Xaiphouthong	0.6
		7	Songkhon	1.2
		8	Xepon	2.4
		9	Nong	2.9
		10	Phalanxai	4.9
		11	Atsaphangthong	7.6
		12	Thapangthong	10.1
		13	Atsaphon	12.0
		14	Xonbouli	20.4
		15	Phin	28.0
17	**Phongsali**	1	Boun_Tai	-13.7
		2	Boun_Nua	-12.0
		3	Gnot_Ou	10.9
		4	Samphan	12.2
		5	Phongsali	13.2
		6	Mai	18.2
		7	Khao	28.1

REDD+ Priority by Forest Use Category

Forest Use Category	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Avg Carbon Density (tC/ha)	11-Year Trend (%/yr)	Score
Production Forest	62.1	60.5	61.1	59.7	57.8	60.1	61.4	60.7	62.1	57.5	56.5	70.1	-0.28	**-25.5**
Non-Forest Category Areas	47.0	45.2	45.2	43.5	42.3	43.7	46.1	44.6	45.0	42.3	41.9	48.0	-0.29	**-21.7**
National Protected Areas	67.8	65.4	66.3	64.6	63.9	65.4	67.2	66.4	66.9	65.2	64.1	76.9	-0.10	**-13.7**
Protection Forest	60.1	60.1	59.9	57.5	57.4	59.7	60.7	59.7	62.2	57.4	56.6	59.2	-0.12	**-11.2**

REDD+ Priority by Individual Forest Use Category Unit

National Protected Areas

NPA Rank	National Rank	Foret Unit Name	Province	Avg Carbon Density (tC/ha)	11-Year Trend (%/yr)	Score
1	4	Nam Phouy	Xayabouri	108.4	-1.1	-114.4
2	20	PhouKhaoKhoay	Vientiane Capital, Vientiane, Bolikhamxay	110.3	-0.22	-42.0
3	24	Nam Kading	Bolikhamxay	110.1	-0.32	-35.9
4	31	Dong Houa Sao	Champasak	63.5	-0.34	-26.1
5	34	Nakai-Nam Theun	Khammuane, Bolikhamxay	103.6	-0.16	-24.0
6	36	Dong Amphan	Attapeu, Sekong	81	-0.28	-22.9
7	37	Laving-Lavern	Savannakhet	133.8	-0.21	-22.8
8	39	HinNamno	Khammuane	95.8	-0.24	-21.8
9	47	PhouHipi	Oudomxay	90.9	-0.11	-19.5
10	61	PhouPhanang	Vientiane Capital, Vientiane	69.3	-0.16	-13.4
11	66	PhouXiengthong	Saravane, Champasak	45.4	-0.15	-10.0
12	69	PhouHinPoun	Khammuane	58.9	-0.25	-9.0
13	71	Namkan	Bokeo, Luangnamtha	77.1	-0.12	-8.3
14	72	Nam Ha	Luangnamtha	76.3	-0.11	-7.8
15	73	PhouSaboot-Pung Chong	Xiengkuang, Houaphanh	41.9	-0.09	-7.5
16	82	XePian	Champasak, Attapeu	59.8	0	-3.2
17	87	Nam Xam	Houaphanh	44.1	0.02	0.9
18	90	Xe Sap	Saravane, Sekong	98.8	0.05	1.7
19	91	Xe Bang Nouan	Savannakhet, Saravane	49.9	0.13	2.3
20	95	Nam Et-Phou Louey	Houaphanh, Xiengkuang, Luangprabang	49.9	0.08	4.9
21	107	PhouXang He	Savannakhet	105.9	0.15	10.2
22	114	Phou Den Din	Phongsaly	56.9	0.29	16.1
23	117	Dong Phou Vieng	Savannakhet	78	0.57	22.0

Production Forest Areas

PFA Rank	National Rank	Forest Unit Name	Province	Avg Carbon Density (tC/ha)	11-Year Trend (%/yr)	Score
1	1	Phoutume	Bolikhamxay	112	-1.62	-198.9
2	2	Phoupasang-Punghok	Bolikhamxay	114	-0.98	-115.6
3	3	PhouGney	Vientiane	64.9	-1.7	-115.4
4	5	Phak Beak	Bolikhamxay	139.4	-0.83	-113.7
5	6	Huaysup-Namtiek	Bolikhamxay	120.9	-0.67	-91.2
6	7	Phouphadam	Xayabouri	57.2	-1.53	-91.1
7	9	PhaNangnuane	Xayabouri	45.3	-1.27	-58.4
8	10	Kengchok-Namnhum	Xayabouri	81.8	-0.76	-58.4
9	14	Houaysiat	Vientiane	86.2	-0.64	-53.6
10	15	Phouviengxai	Bokeo	71.6	-0.7	-52.1
11	18	Namchong-Namgneup	Bokeo	107.1	-0.37	-44.9
12	21	Silivangveun	Champasak	44	-0.72	-41.1
13	25	Nongpet-Naseng	Vientiane	94.5	-0.35	-33.0
14	26	Namboun	Phongsaly	50.7	-0.66	-31.6
15	29	PhaNangnoi	Xayabouri	55.6	-0.52	-27.2
16	32	Phouphadeng	Xayabouri	60.3	-0.42	-25.7
17	33	Nam Nga	Oudomxay	67.3	-0.43	-24.4
18	35	Xienglouang	Sekong	32.3	-0.86	-23.5
19	40	Namdee	Sekong	86.8	-0.11	-21.6
20	42	Phoulouang-Tai	Luangprabang	50.4	-0.39	-21.4
21	43	Sainamkhan	Luangprabang	38.9	-0.59	-21.0
22	44	Phadeng	Houaphanh	39.9	-0.47	-20.7
23	45	Nongtangok	Champasak	52.2	-0.31	-20.5
24	46	HuayGnang	Xayabouri	104.2	-0.16	-20.3
25	48	Pathoumphone	Champasak	45.6	-0.33	-18.6
26	50	Phousamliam	Vientiane	99.4	-0.13	-17.8
27	51	Ban Bengvilay	Attapeu	64.4	-0.26	-17.3

Production Forest Areas

PFA Rank	National Rank	Forest Unit Name	Province	Avg Carbon Density (tC/ha)	11-Year Trend (%/yr)	Score
28	52	Lao Ngam	Saravane	42	-0.28	-16.7
29	53	Nammo	Xiengkuang	102.6	-0.05	-16.7
30	54	Namkong	Attapeu	51.6	-0.25	-16.4
31	57	Saykhong	Oudomxay	57.7	-0.27	-15.7
32	58	Nampa-Huayvy	Attapeu	64	-0.25	-15.4
33	63	Prong	Sekong	106.2	-0.08	-12.2
34	65	Phouleed-Longmoun	Luangnamtha	75.6	-0.14	-10.7
35	75	PhouTalava	Saravane	67.2	0.01	-6.6
36	79	Dakchang	Sekong	73	-0.06	-4.7
37	81	Namfa	Luangnamtha	61.4	0.01	-4.1
38	83	Sammuang	Bokeo	64.8	-0.08	-1.8
39	89	Nakathing-Nongkapath	Khammuane	119.3	0.09	1.5
40	92	Dong Phouxoi	Khammuane	80.9	0.25	2.7
41	93	Dong Sithuane	Savannakhet	51.3	0.19	4.5
42	97	Namphart	Oudomxay	57.4	0.1	5.6
43	100	Phouphaphiang	Vientiane	71	0.36	7.0
44	102	Longkhan-Longkhao	Bokeo	48.3	0.11	7.9
45	103	Phoulieu	Houaphanh	34.8	0.27	8.2
46	104	Huaypen	Sekong	52.4	0.24	8.3
47	106	Huaykho	Houaphanh	43.3	0.2	9.8
48	109	Phoukateum	Sekong	84.7	0.13	11.3
49	112	Namban-Palan	Phongsaly	38.4	0.47	15.2
50	119	Dongkapho	Savannakhet	46.9	0.77	33.1
51	120	Dakmong	Saravane	122.2	0.29	38.2

Protection Forest Areas

PTA Rank	Total Rank	Forest Unit Name	Province	Avg Carbon Density (tC/ha)	11-Year Trend (%/yr)	Score
1	8	Thonghaeng-Namhuong	Xayabouri	85.2	-0.64	-63.3
2	11	LaengNamfueang	Vientiane, Luangprabang	97.1	-0.62	-58.3
3	12	Ph.muc-Nhotnammee	Xayabouri, Vientiane	49.4	-1.06	-54.7
4	13	Laengnamnghiep_Nammang	Vientiane, Bolikhamxay	121.5	-0.43	-54.1
5	16	Laengnambeng	Oudomxay	58.8	-0.8	-47.9
6	17	Nhotnamlik	Vientiane	89	-0.62	-45.6
7	19	Thamon-namkho	Xayabouri, Bokeo, Oudomxay	54.7	-0.82	-43.2
8	22	Namngao_namou tai	Luangprabang, Oudomxay	58.8	-0.62	-40.5
9	23	LaengNamnhang,Namngim	Xayabouri	89.7	-0.48	-37.8
10	27	Laengnamtha	Bokeo, Luangnamtha, Oudomxay	65	-0.46	-30.0
11	28	P.Luong_Mokaen	Xayabouri, Bokeo, Oudomxay	50.3	-0.54	-29.8
12	30	Laengnamngum	Vientiane	90.4	-0.18	-27.0
13	38	Sayphoudamlek	Champasak	55.7	-0.36	-22.3
14	41	P.thaenchau-P.hai	Khammuane, Bolikhamxay	85.5	-0.24	-21.4
15	49	LaengNamma	Houaphanh	34.7	-0.56	-18.3
16	55	Nhotnamphouthiengbolivaenh	Champasak, Saravane, Attapeu, Sekong	52.3	-0.38	-15.7
17	56	Laengnamkan	Luangprabang	47.7	-0.29	-15.7
18	59	LaengNamnean-Nampean	Houaphanh	38.5	-0.35	-14.4
19	60	LaengNamxekong-Xekaman	Sekong	79.1	-0.12	-14.2
20	62	Phoulom,Namkaung-Namnhon	Bokeo	63.3	-0.25	-13.1
21	64	NhotNamaet,Namxam	Houaphanh	39.7	-0.33	-11.9
22	67	Laengnammai	Luangnamtha	59.7	-0.12	-9.7
23	68	Laeng Nam ma	Bokeo, Luangnamtha	55.1	-0.05	-9.4
24	70	Ph.Mieng-Ph.Keoudon	Xayabouri, Luangprabang, Oudomxay	77.4	-0.08	-8.8
25	74	Ph.Samnhot-Nhotnamphak	Phongsaly, Luangnamtha, Oudomxay	54	-0.09	-6.7
26	76	P.katae-NhotXelanong	Saravane, Sekong	80.6	-0.04	-6.2
27	77	LaengNammat	Xiengkuang	36.4	-0.08	-5.6

Protected Forest Areas

PTA Rank	Total Rank	Forest Unit Name	Province	Avg Carbon Density (tC/ha)	11-Year Trend (%/yr)	Score
28	78	Soppaen-H.Ko	Houaphanh	42.1	-0.09	-5.4
29	80	LaengNamthat-Namting	Luangprabang	32.8	-0.07	-4.4
30	84	Namxam_Namsim	Houaphanh	41.9	-0.02	-1.8
31	85	Laengxepon-Ph.ong	Saravane, Savannakhet	83.1	0.11	-0.7
32	86	Laengnamsuong-Saeng	Luangprabang	37.2	0	-0.4
33	88	LaengNamngai-Namlan	Phongsaly	41.1	0.03	1.1
34	94	Xekaman1	Attapeu	60.9	0.01	4.7
35	96	LaengNamou N	Phongsaly	37.2	0.18	5.2
36	98	NhotNammuon-Namnhoung	Bolikhamxay	96.8	0.15	6.1
37	99	LaengNamkong-Xexou	Attapeu	59.6	0.16	6.3
38	101	LaengNamHouyvy-Phoukoungking-Xekaman	Sekong	71.5	0.2	7.6
39	105	Xechamphone	Savannakhet	36.2	0.38	9.6
40	108	NhotNamngum	Xiengkuang	36.7	0.28	11.0
41	110	Nhot Nam ou	Phongsaly	34.8	0.43	11.8
42	111	NhotNamnghiep	Xiengkuang	44.2	0.61	14.2
43	113	Nambout, Nampark	Luangprabang, Phongsaly, Oudomxay	62.3	0.43	15.5
44	115	Laeng Nam mo	Xiengkuang	58.8	0.42	18.2
45	116	LaengNammouk-Nammart	Luangprabang, Phongsaly	39.1	0.47	18.9
46	118	Xebangnoun-P.khaunak	Saravane, Savannakhet	58.1	0.52	24.5

Non-Categorized Areas

Note – Two districts, Xaisathan District in Sayabouri Province and Pek District in Xiengkhouang Province, are not ranked in this table, as they contain no non-categorized areas.

Province Rank	Province	District Rank	District	Score
1	Bolikhamxay	1	Pakkading	-186.7
		2	Bolikhan	-118.7
		3	Pakxan	-49.5
		4	Viangthong	-41.6
		5	Thaphabat	-40.0
		6	Khamkeut	-6.6
		7	Xaichamphon	15.7
2	Vientiane	1	Hom	-81.0
		2	Mun	-79.7
		3	Hinheup	-76.6
		4	Fuang	-70.5
		5	Xanakham	-60.6
		6	Kasi	-60.6
		7	Met	-58.1
		8	Vangviang	-32.0
		9	Xaisomboun	-29.6
		10	Phonhong	-21.2
		11	Viangkham	-16.5
		12	Keo_Oudom	-15.4
		13	Thoulakhom	0.3
3	Bokeo	1	Pha_Oudom	-66.0
		2	Paktha	-56.2
		3	Houyxay	-47.3
		4	Thonpheung	-33.0
		5	Meung	-19.4
4	Sayabouri	1	Phiang	-89.7
		2	Thongmixai	-83.5
		3	Paklay	-54.2

Province Rank	Province	District Rank	District	Score
		4	Kenthao	-45.4
		5	Khop	-43.5
		6	Ngeun	-24.6
		7	Xianghon	-23.0
		8	Xaignabouli	-20.6
		9	Boten	-15.4
		10	Hongsa	11.7
5	Khammuane	1	Nakay	-159.8
		2	Hinboun	-78.1
		3	Khounkham	-59.1
		4	Thakhek	-26.0
		5	Xebangfai	-16.7
		6	Boualapha	-7.3
		7	Gnommalat	-1.1
		8	Mahaxai	5.1
		9	Nongbok	11.0
		10	Xaibouathong	25.7
6	LuangNamtha	1	Louangnamtha	-64.5
		2	Sing	-37.3
		3	Viangphoukha	-32.2
		4	Long	-24.3
		5	Nale	-9.7
7	Oudomxay	1	Houn	-47.7
		2	Na_Mo	-47.1
		3	Xai	-42.1
		4	Beng	-41.1
		5	Pakbeng	-39.1
		6	La	-3.2
		7	Nga	4.3
8	Vientiane Capital	1	Sangthong	-61.3

Province Rank	Province	District Rank	District	Score
		2	Pak_Ngum	-16.3
		3	Xaixettha	-10.5
		4	Hatxayfong	-10.3
		5	Naxaythong	-3.9
		6	Sikhottabong	-3.7
		7	Xaithani	-0.8
		8	Sisattanak	0.0
		9	Chanthabouli	0.1
9	Xiengkhouang	1	Thathom	-70.0
		2	Mok	-12.5
		3	Kham	0.5
		4	Nonghet	2.2
		5	Phaxai	13.1
		6	Phoukout	13.2
		7	Khoun	25.0
10	Champassak	1	Bachiangchaleunsouk	-48.6
		2	Pathoumphon	-26.8
		3	Champasak	-16.7
		4	Pakxong	-9.2
		5	Mounlapamok	-9.1
		6	Soukhouma	-3.7
		7	Khong	-2.8
		8	Pakxe	-0.1
		9	Phonthong	2.6
		10	Xanasomboun	3.3
11	Attapeu	1	Phouvong	-29.6
		2	Xanxai	-14.0
		3	Sanamxai	-10.1
		4	Samakhixai	-10.1
		5	Xaixettha	3.8

Province Rank	Province	District Rank	District	Score
12	LuangPrabang	1	Pak_Ou	-27.2
		2	Phoukhoun	-25.6
		3	Nan	-19.8
		4	Nambak	-19.8
		5	Louangphabang	-16.8
		6	Xiang_Ngeun	-14.8
		7	Champhet	-9.7
		8	Phonxai	-8.2
		9	Viangkham	-8.0
		10	Pakxeng	2.8
		11	Ngoy	16.5
		12	Phonthong	21.2
13	Houaphan	1	Et	-20.5
		2	Sopbao	-17.6
		3	Viangxai	-17.2
		4	Xam-Tai	-16.4
		5	Xiangkho	-13.7
		6	Xamnua	-4.6
		7	Kouan	-2.3
		8	Houamouang	-1.6
		9	Viangthong	7.2
14	Saravane	1	Lao_Ngam	-24.6
		2	Nakhonpheng	-8.9
		3	Samouay	-0.4
		4	Ta_Oy	1.9
		5	Salavan	4.5
		6	Khongxedon	4.5
		7	Vapi	10.6
		8	Toumlan	18.6
15	Savannakhet	1	Vilabouli	-29.0

Province Rank	Province	District Rank	District	Score
		2	Xaibouli	-22.3
		3	Outhoumphon	-11.8
		4	KaysonePhomvihane	-3.9
		5	Nong	-1.3
		6	Champhon	-0.3
		7	Xaiphouthong	0.5
		8	Songkhon	0.7
		9	Xepon	2.0
		10	Atsaphon	5.6
		11	Atsaphangthong	6.2
		12	Phalanxai	7.6
		13	Xonbouli	19.3
		14	Thapangthong	24.3
		15	Phin	25.9
16	Sekong	1	Thateng	-25.0
		2	Lamam	10.7
		3	Kalum	11.5
		4	Dakchung	12.9
17	Phongsali	1	Boun_Nua	-21.9
		2	Boun_Tai	-14.9
		3	Gnot_Ou	10.4
		4	Samphan	14.3
		5	Phongsali	19.7
		6	Mai	20.7
		7	Khao	32.2

REDD+ Priority by Forest Use Category Rank – Organized by Province

Province	Forest Category	Forest Unit Name	Avg Carbon Density (tC/ha)	11-Year Trend (%/yr)	Score
Attapeu	NPA	Dong Amphan	79.1	-0.28	-21.9
	PTA	Nhotnamphouthiengbolivaenh	60.5	-0.28	-18.2
	PFA	Ban Bengvilay	64.4	-0.26	-17.3
	PFA	Namkong	51.6	-0.25	-16.4
	PFA	Nampa-Huayvy	64	-0.25	-15.4
	PTA	Xekaman1	60.9	0.01	4.7
	PTA	LaengNamkong-Xexou	59.6	0.16	6.3
	NPA	XePian	41.9	0.59	20.7
Bokeo	PFA	Phouviengxai	71.6	-0.7	-52.1
	PFA	Namchong-Namgneup	107.1	-0.37	-44.9
	PTA	Laengnamtha	64.1	-0.52	-30.0
	PTA	Thamon-namkho	45.6	-0.48	-26.8
	PTA	P.Luong_Mokaen	42.3	-0.4	-22.7
	PTA	Phoulom, Namkaung-Namnhon	63.3	-0.25	-13.1
	NPA	Namkan	76.5	-0.09	-3.5
	PFA	Sammuang	64.8	-0.08	-1.8
	PTA	Laeng Nam ma	68.7	0.09	6.2
	PFA	Longkhan-Longkhao	48.3	0.11	7.9
Bolikhamxay	PFA	Phoutume	112	-1.62	-198.9
	PFA	Phoupasang-Punghok	114	-0.98	-115.6
	PFA	Phak Beak	139.4	-0.83	-113.7
	PTA	Laengnamnghiep_Nammang	115.3	-0.76	-91.7
	PFA	Huaysup-Namtiek	120.9	-0.67	-91.2
	NPA	PhouKhaoKhoay	122.7	-0.53	-71.7
	NPA	Nam Kading	110.1	-0.32	-35.9
	PTA	P.thaenchau-P.hai	79.7	-0.05	-0.2
	PTA	NhotNammuon-Namnhoung	96.8	0.15	6.1
	NPA	Nakai-Nam Theun	86.1	0.18	15.6

Province	Forest Category	Forest Unit Name	Avg Carbon Density (tC/ha)	11-Year Trend (%/yr)	Score
Champasak	PFA	Silivangveun	44	-0.72	-41.1
	NPA	Dong Houa Sao	63.5	-0.34	-26.1
	PTA	Sayphoudamlek	55.7	-0.36	-22.3
	PFA	Nongtangok	52.2	-0.31	-20.5
	PFA	Pathoumphone	45.6	-0.33	-18.6
	PTA	Nhotnamphouthiengbolivaenh	47.5	-0.41	-14.7
	NPA	XePian	63.7	-0.14	-8.5
	NPA	PhouXiengthong	46.5	-0.07	-5.6
Houaphanh	PFA	Phadeng	39.9	-0.47	-20.7
	PTA	LaengNamma	34.7	-0.56	-18.3
	PTA	LaengNamnean-Nampean	38.5	-0.35	-14.4
	PTA	NhotNamaet,Namxam	39.7	-0.33	-11.9
	PTA	Soppaen-H.Ko	42.1	-0.09	-5.4
	PTA	Namxam_Namsim	41.9	-0.02	-1.8
	NPA	Nam Xam	44.1	0.02	0.9
	NPA	Nam Et-PhouLouey	50	0.06	4.2
	NPA	PhouSaboot-Pung Chong	40.4	0.15	5.9
	PFA	Phoulieu	34.8	0.27	8.2
	PFA	Huaykho	43.3	0.2	9.8
Khammuane	PTA	P.thaenchau-P.hai	102.4	-0.77	-77.4
	NPA	Nakai-Nam Theun	105	-0.19	-27.2
	NPA	HinNamno	95.8	-0.24	-21.8
	NPA	PhouHinPoun	58.9	-0.25	-9.0
	PFA	Nakathing-Nongkapath	119.3	0.09	1.5
	PFA	Dong Phouxoi	80.9	0.25	2.7
Luangnamtha	NPA	Namkan_Luangnamtha	78.5	-0.2	-18.4
	PTA	Ph.Samnhot-Nhotnamphak	57.4	-0.22	-15.0
	PTA	Laengnamtha	64.4	-0.24	-14.7
	PFA	Phouleed-Longmoun	75.6	-0.14	-10.7

Province	Forest Category	Forest Unit Name	Avg Carbon Density (tC/ha)	11-Year Trend (%/yr)	Score
	PTA	Laeng Nam ma	54.2	-0.07	-10.2
	PTA	Laengnammai	59.7	-0.12	-9.7
	NPA	Nam Ha	76.3	-0.11	-7.8
	PFA	Namfa	61.4	0.01	-4.1
Luangprabang	PTA	LaengNamfueang	87	-0.6	-50.4
	PTA	Namngao_namou tai	37.7	-0.77	-32.7
	PFA	Phoulouang-Tai	50.4	-0.39	-21.4
	PFA	Sainamkhan	38.9	-0.59	-21.0
	PTA	Laengnamkan	47.7	-0.29	-15.7
	PTA	LaengNamthat-Namting	32.8	-0.07	-4.4
	PTA	Ph.Mieng-Ph.Keoudon	92.6	0.1	-2.6
	PTA	Laengnamsuong-Saeng	37.2	0	-0.4
	NPA	Nam Et-PhouLouey	54.4	0.21	10.4
	PTA	LaengNammouk-Nammart	43.3	0.49	21.3
	PTA	Nambout, Nampark	49.8	0.54	23.6
Oudomxay	PTA	Laengnambeng	58.8	-0.8	-47.9
	PTA	Namngao_namou tai	76.1	-0.5	-46.7
	PTA	Laengnamtha	65.8	-0.57	-39.6
	PTA	P.Luong_Mokaen	52.8	-0.7	-39.1
	PFA	Nam Nga	67.3	-0.43	-24.4
	PTA	Nambout, Nampark	79.8	-0.11	-23.3
	NPA	PhouHipi	90.9	-0.11	-19.4
	PFA	Saykhong	57.7	-0.27	-15.7
	PTA	Ph.Samnhot-Nhotnamphak	51.1	0.01	0.2
	PFA	Namphart	57.4	0.1	5.6
Phongsaly	PFA	Namboun	50.7	-0.66	-31.6
	PTA	Ph.Samnhot-Nhotnamphak	16	0.88	-2.1
	PTA	LaengNamngai-Namlan	41.1	0.03	1.1
	PTA	LaengNamou N	37.2	0.18	5.2

Province	Forest Category	Forest Unit Name	Avg Carbon Density (tC/ha)	11-Year Trend (%/yr)	Score
	PTA	Nhot Nam ou	34.8	0.43	11.8
	PFA	Namban-Palan	38.4	0.47	15.2
	NPA	Phou Den Din	56.9	0.29	16.1
	PTA	LaengNammouk-Nammart	36	0.47	17.5
	PTA	Nambout, Nampark	62.3	0.98	55.6
Saravane	PFA	Lao Ngam	42	-0.28	-16.7
	NPA	PhouXiengthong	44.8	-0.19	-12.2
	PFA	PhouTalava	67.2	0.01	-6.6
	PTA	P.katae-NhotXelanong	80.6	0	-4.3
	PTA	Laengxepon-Ph.ong	85.3	0.11	-3.2
	PTA	Nhotnamphouthiengbolivaenh	17.5	-0.33	-0.9
	NPA	Xe Bang Nouan	49.5	0.16	3.3
	NPA	Xe Sap	98.1	0.07	5.3
	PTA	Xebangnoun-P.khaunak	60.7	0.31	10.7
	PFA	Dakmong	122.2	0.29	38.2
Savannakhet	NPA	Laving-Lavern	133.8	-0.21	-22.8
	NPA	Xe Bang Nouan	51.3	0.02	-1.1
	PTA	Laengxepon-Ph.ong	80.7	0.11	2.2
	PFA	Dong Sithuouane	51.3	0.19	4.5
	PTA	Xechamphone	36.2	0.38	9.6
	NPA	PhouXang He	105.9	0.15	10.2
	NPA	Dong PhouVieng	78	0.57	22.0
	PTA	Xebangnoun-P.khaunak	57.3	0.6	28.9
	PFA	Dongkapho	46.9	0.77	33.1
Sekong	NPA	Dong Amphan	94	-0.28	-29.6
	PFA	Xienglouang	32.3	-0.86	-23.5
	PTA	P.katae-NhotXelanong	80.4	-0.39	-21.7
	PFA	Namdee	86.8	-0.11	-21.6
	PTA	Nhotnamphouthiengbolivaenh	72.2	-0.4	-16.9

Province	Forest Category	Forest Unit Name	Avg Carbon Density (tC/ha)	11-Year Trend (%/yr)	Score
	PTA	LaengNamxekong-Xekaman	79.1	-0.12	-14.2
	PFA	Prong	106.2	-0.08	-12.2
	PFA	Dakchang	73	-0.06	-4.7
	NPA	Xe Sap	99.8	0.01	-3.4
	PTA	LaengNamHouyvy-Phoukoungking-Xekaman	71.5	0.2	7.6
	PFA	Huaypen	52.4	0.24	8.3
	PFA	Phoukateum	84.7	0.13	11.3
Vientiane	PFA	PhouGney	64.9	-1.7	-115.4
	PTA	LaengNamfueang	142.5	-0.73	-93.3
	PFA	Houaysiat	86.2	-0.64	-53.6
	PTA	Ph.muc-Nhotnammee	47.5	-1	-49.4
	PTA	Laengnamnghiep_Nammang	122.5	-0.37	-46.9
	PTA	Nhotnamlik	89	-0.62	-45.6
	PFA	Nongpet-Naseng	94.5	-0.35	-33.0
	PTA	Laengnamngum	90.4	-0.18	-27.0
	NPA	PhouPhanang	67.8	-0.28	-25.5
	PFA	Phousamliam	99.4	-0.13	-17.8
	PFA	Phouphaphiang	71	0.36	7.0
	NPA	PhouKhaoKhoay	80.2	0.45	21.7
Vientiane Capital	NPA	PhouKhaoKhoay	122.2	-0.16	-40.8
	NPA	PhouPhanang	69.9	-0.12	-8.9
Xayabouri	NPA	Nam Phouy	108.4	-1.1	-114.4
	PFA	Phouphadam	57.2	-1.53	-91.1
	PTA	Ph.muc-Nhotnammee	53.3	-1.16	-64.2
	PTA	Thonghaeng-Namhuong	85.2	-0.64	-63.3
	PFA	PhaNangnuane	45.3	-1.27	-58.4
	PFA	Kengchok-Namnhum	81.8	-0.76	-58.4
	PTA	Thamon-namkho	55.8	-0.86	-44.8

Province	Forest Category	Forest Unit Name	Avg Carbon Density (tC/ha)	11-Year Trend (%/yr)	Score
	PTA	LaengNamnhang,Namngim	89.7	-0.48	-37.8
	PFA	PhaNangnoi	55.6	-0.52	-27.2
	PFA	Phouphadeng	60.3	-0.42	-25.7
	PFA	HuayGnang	104.2	-0.16	-20.3
	PTA	P.Luong_Mokaen	50.3	-0.4	-19.8
	PTA	Ph.Mieng-Ph.Keoudon	74.6	-0.11	-9.6
Xiengkuang	PFA	Nammo	102.6	-0.05	-16.7
	NPA	PhouSaboot-Pung Chong	42	-0.09	-7.6
	PTA	LaengNammat	36.4	-0.08	-5.6
	PTA	NhotNamngum	36.7	0.28	11.0
	NPA	Nam Et-PhouLouey	33.5	0.38	11.2
	PTA	NhotNamnghiep	44.2	0.61	14.2
	PTA	Laeng Nam mo	58.8	0.42	18.2

Climate Protection through Avoided Deforestation (CliPAD)

Mapping Priority Jurisdictions for REDD+ in Lao PDR

Analysis and Priority Rankings

Deutsche Gesellschaft für
Internationale Zusammenarbeit (GIZ) GmbH
P.O Box 9233, Vientiane
Lao PDR

T: ++85621-353605-105
F: ++85621-312408
I: www.giz.de