

Part Four

SUMMARY AND CONCLUSIONS

Characterisation of Districts Based on Selected RNR Indicators

Despite its small size, Bhutan has a very diverse landscape with widely varying agroecological characteristics. The land types range from lowlands suitable for arable farming to purely pastoral rangelands and high mountains. The overall characteristics of and differences between the districts of Bhutan can be shown using selected indicators related to land use, agricultural production, and other factors. These indicators can be used to explore the limitations and potential for agricultural development.

A total of eleven RNR indicators were identified and developed by the Policy and Planning Division, Ministry of Agriculture, Bhutan, and used to define indicators of development in the context of a spatial food security assessment. The indicators were selected on the basis of data availability (either already available or likely to be available in the future), reliability, and validity for the purpose; and whether they could be quantified and were not biased with respect to social, economic, productive, or other considerations. These indicators are useful because they facilitate characterisation of the districts, and enable rapid comparisons to be made.

In this section, the indicators are listed and the district rank for each shown in a table. This information is presented visually in the form of maps to provide an 'at-a-glance' view of the agricultural development status of the districts.

RNR indicators

A total of eleven indicators were identified as listed below (in no particular order).

1. *Percentage of households owning wetland* (chushing; i.e. terraced land, mostly irrigated) is defined as the number of households owning wetland divided by the total number of households. Ownership of wetland is associated with stable, productive farming. This indicator essentially shows the distribution of paddy fields.
2. *Percentage of households owning three or more acres of arable land* is defined as the percentage of total households owning at least three acres of wetland (chushing) and dryland (kamshing) together. Owning more than three acres of arable land is a good indication that a household is self-sufficient in and has stable food production.
3. *Cereal production per household* is defined as the total cereal production for that district (in tonnes) divided by the total number of households. This indicator is directly related to food security and income generation and shows the potential for food self-sufficiency in a district.
4. *Wetland area per household* is defined as the total area of wetland in a district (acres) divided by the total number of households per district. The wetland area per household, especially when considered in conjunction with the percentage of households owning wetland, is indicative of the rate of food self-sufficiency.
5. *Wetland as a percentage of total arable land* is defined as the area of wetland in a district divided by the total of wetland plus dryland, multiplied by 100. This value is used to indicate areas where agriculture is relatively productive, stable, and sustainable, and may have a good potential for further intensification.

6. *Percentage of households that do not practise shifting cultivation* is defined as the total number of households minus those that practise shifting cultivation divided by the total number of households multiplied by 100. Low values mean that a large proportion of households practise shifting cultivation and indicate the likelihood of food insecurity, tenure insecurity, and risks of degradation if shifting cultivation is converted to permanent cultivation*.
7. *Arable land as a percentage of total agricultural land* is defined as the total area of wetland plus the total area of dryland divided by the total agricultural land times 100. Total agricultural land is total arable land plus total shifting cultivation area, thus the indicator indicates the relative proportion of shifting cultivation land. A high value indicates stability and relative food and tenure security.
8. *Percentage of households producing apples and oranges* is defined as the percentage of households cultivating apples plus the percentage of households cultivating oranges. [Note that in some cases a household may be counted twice.] Apples and oranges are important horticultural tree crops; a high degree of this type of horticulture indicates land use intensification, market access, and potential income generation.
9. *Number of fruit trees per household*. This is the total number of cultivated fruit trees in a district divided by the number of households. It indicates the relative importance of fruit trees in a district and the implied land use intensification, market access, and potential income generation.
10. *Number of economic livestock units per household*. The number of livestock are converted into 'economic livestock units' using the conversion of one unit equals 1 yak, 1 mule, 1 donkey, 2 cows, 2 horses, 5 pigs, 10 sheep or goats, or 100 poultry. The number of livestock units in a district is divided by the total number of households. This value indicates stored or accumulated wealth and the ability to purchase food grain and other food; it is an alternative way of showing food self-sufficiency.
11. *Percentage of households less than one hour from a motorable road* is defined as the number of households that reported that they were living less than one hour from a motorable road as a percentage of the total number of households. It indicates the potential for marketing agricultural products and the opportunity to purchase basic food requirements.

The values of each of the above indicators were calculated for each of the 20 districts and the districts ranked in the order of the values with rank 20 the best and rank 1 the least good. The rank values for individual indicators were summed to provide an overall indication of the relative district rank. The summing was not weighted, that is indicators were rated as equally important. The results are shown in Table 4.1 and illustrated in Maps R1 to R3 (individual indicators) and R4 (overall ranking). In the maps, the ranking is shown in ranges of ranks 15-20 (high), ranks 8-14 (medium) and ranks 1-8 (low).

* But note that ideas on the appropriateness of shifting cultivation (better called rotational agroforestry) are changing with increasing recognition of its benefits and the positive role this form of agriculture can play. See the recent ICIMOD publication E. Kerkhoff and E. Sharma (2006) *Debating Shifting Cultivation in the Eastern Himalayas – Farmers' Innovations as Lessons for Policy* [ed]

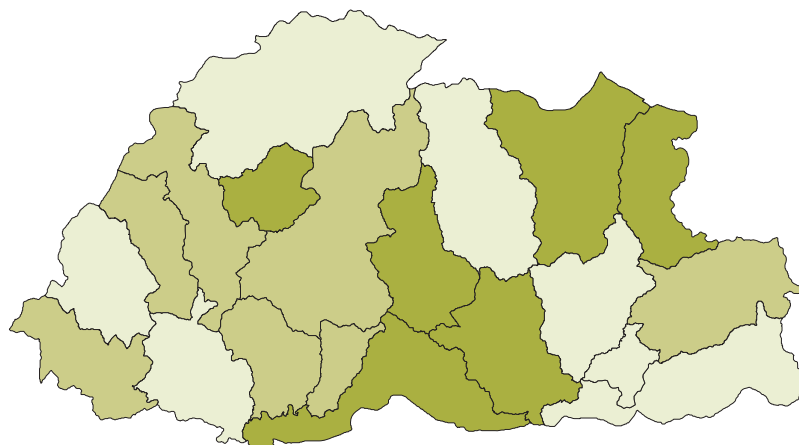
Table 4.1 District ranking according to different agricultural indicators

District	% of HHs owning wetland	% of HHs owning >3 acres arable land	Cereal production per HH	Wetland per HH	% Wetland / arable land	% Not practising shifting cultivation	% arable land/ tot. agric. land	% HH producing apples/oranges	Fruit trees/HH	Livestock Units per HH	% HHs <1 hr from road	Sum of Values	Overall Ranking
Paro	12	11	9	15	17	11	9	15	18	14	20	168	20
Punakha	20	5	20	20	20	5	20	20	9	7	15	166	19
Sarpang	15	19	19	19	13	19	19	19	20	9	16	162	18
Thimphu	9	7	6	12	19	7	6	12	15	18	18	152	17
Tsirang	11	12	16	17	14	12	16	17	12	5	13	146	16
Gasa	5	3	3	8	16	3	3	8	5	16	12	141	15
Dagana	13	15	17	14	10	15	17	14	13	8	11	130	14
Trongsa	19	13	8	13	15	13	8	13	7	15	14	127	13
Zhemgang	17	18	15	11	9	18	15	11	16	12	2	121	12
Samtse	10	16	12	16	11	16	12	16	14	4	9	120	11
Chhukha	7	17	5	9	7	17	5	9	19	13	10	109	10
Mongar	6	4	11	3	3	4	11	3	4	11	7	104	9
S/Jongkhar	4	14	18	6	5	14	18	6	17	3	4	104	9
Ha	3	8	2	2	4	8	2	2	11	19	17	101	7
Wangdue	14	6	13	18	18	6	13	18	1	20	1	91	6
Bumthang	2	20	1	2	2	20	1	2	8	17	19	87	5
Lhuntse	16	10	14	10	12	10	14	10	6	6	6	79	4
Trashi Yangtse	18	2	7	7	8	2	7	7	2	10	3	79	4
Trashigang	8	9	10	5	6	9	10	5	3	2	8	74	2
Pemagatshel	1	1	4	1	1	1	4	1	10	1	5	49	1

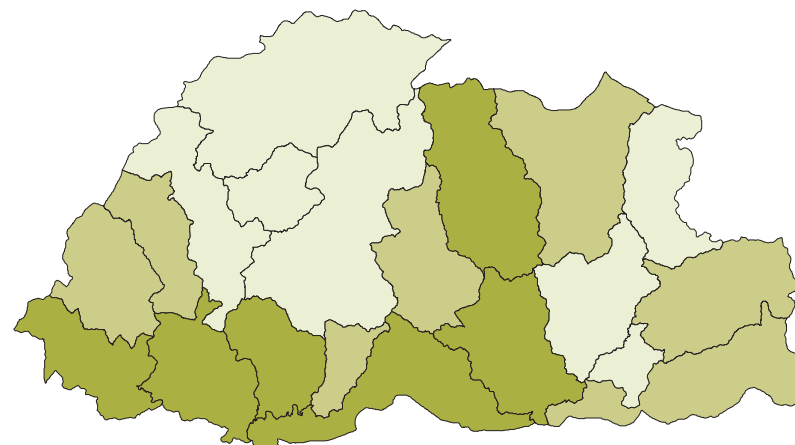
Note: Acre is the standard unit of area used in Bhutan.

Ranking of Districts Based on Selected RNR Indicators

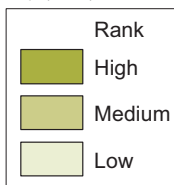
Percentage of households owning wetland



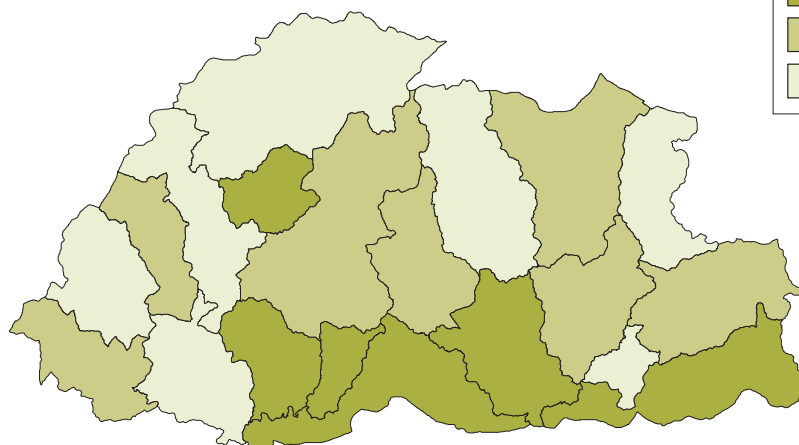
Percentage of households owning >3 acres arable land



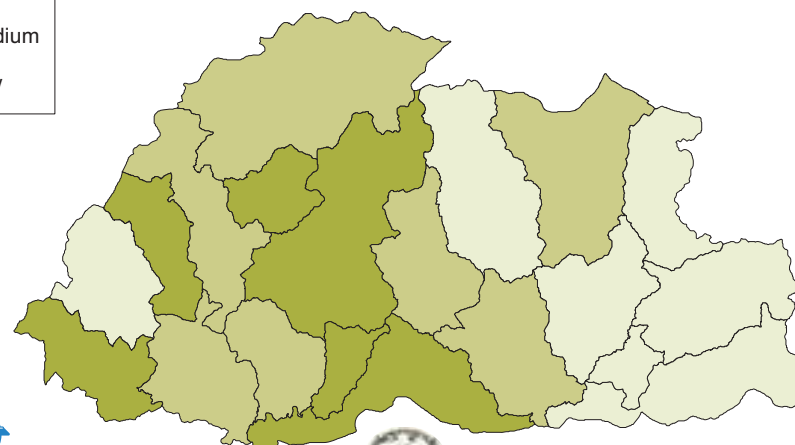
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Cereal production per household



Wetland area per household



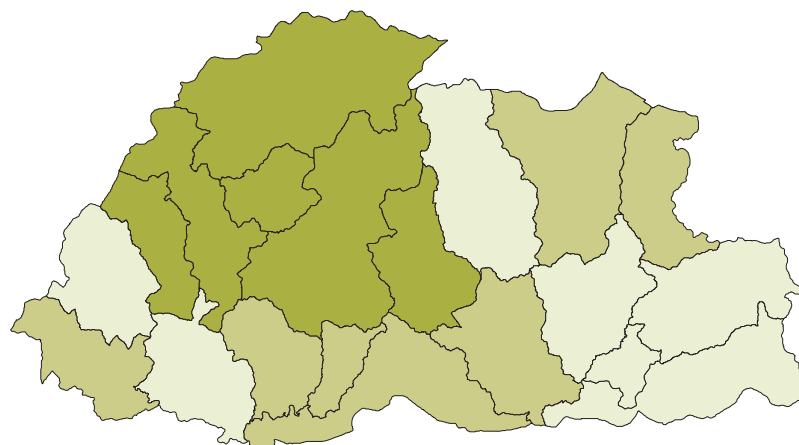
0 12.5 25 50 75 100
Kilometres

Base Map: Department of Survey and Land Records,
Ministry of Agriculture
Data Source: RNR Statistics 2000, Ministry of Agriculture

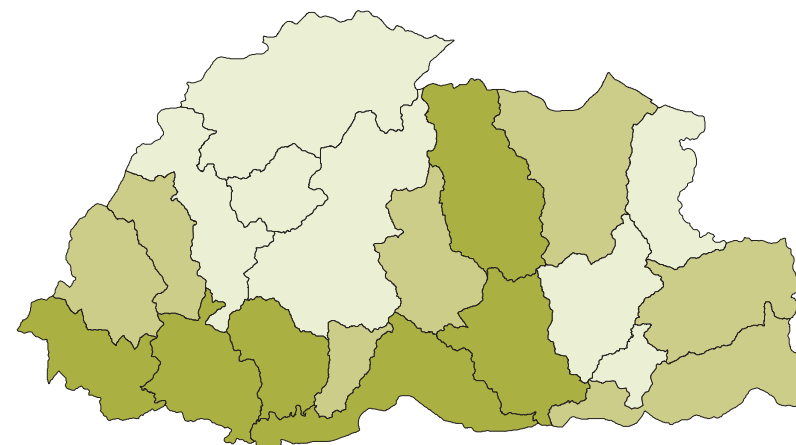


Ranking of Districts Based on Selected RNR Indicators

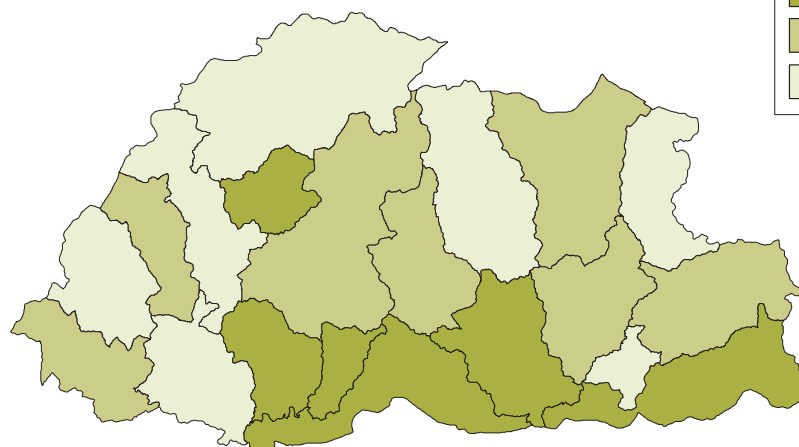
Wetland as a percentage of total arable land



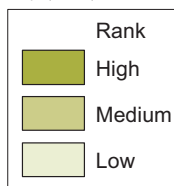
Percentage of households that DO NOT practise shifting cultivation



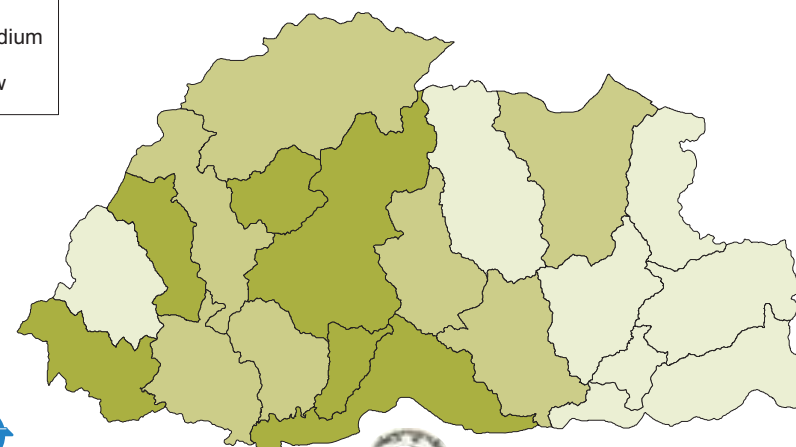
Arable land as a percentage of total agricultural land



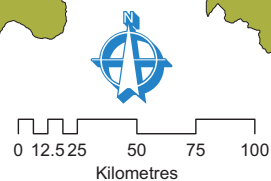
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Percentage of households producing apples and oranges



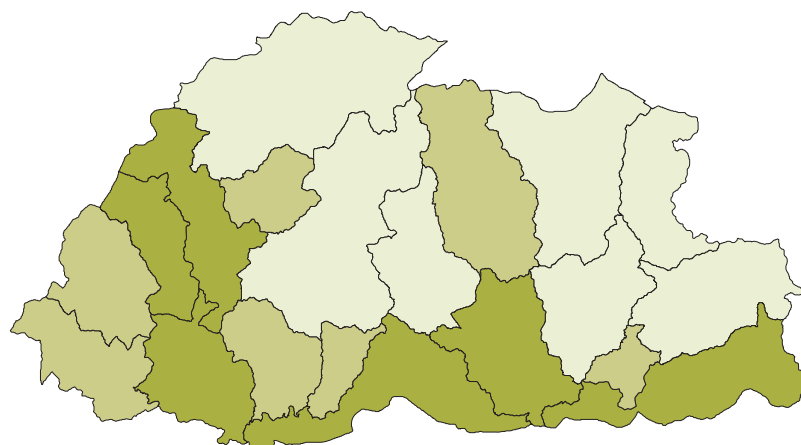
Base Map: Department of Survey and Land Records,
Ministry of Agriculture
Data Source: RNR Statistics 2000, Ministry of Agriculture



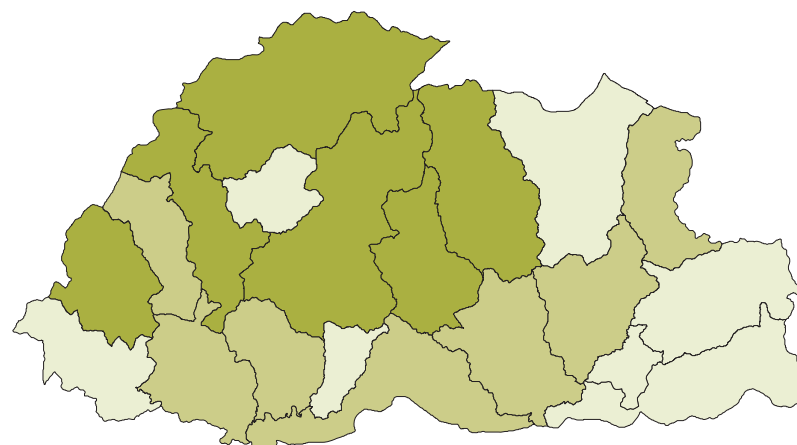
Ranking of Districts Based on Selected RNR Indicators

R 3

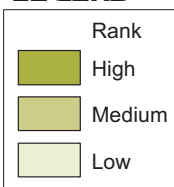
Number of fruit trees per household



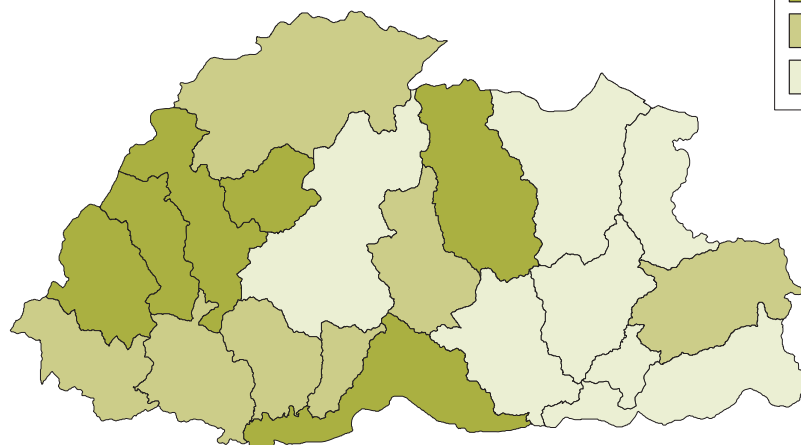
Number of economic livestock units per household



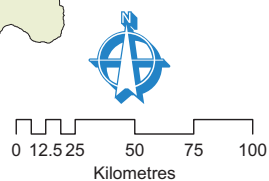
LEGEND



Percentage of households less than one hour from a motorable road



Base Map: Department of Survey and Land Records,
Ministry of Agriculture
Data Source: RNR Statistics 2000, Ministry of Agriculture







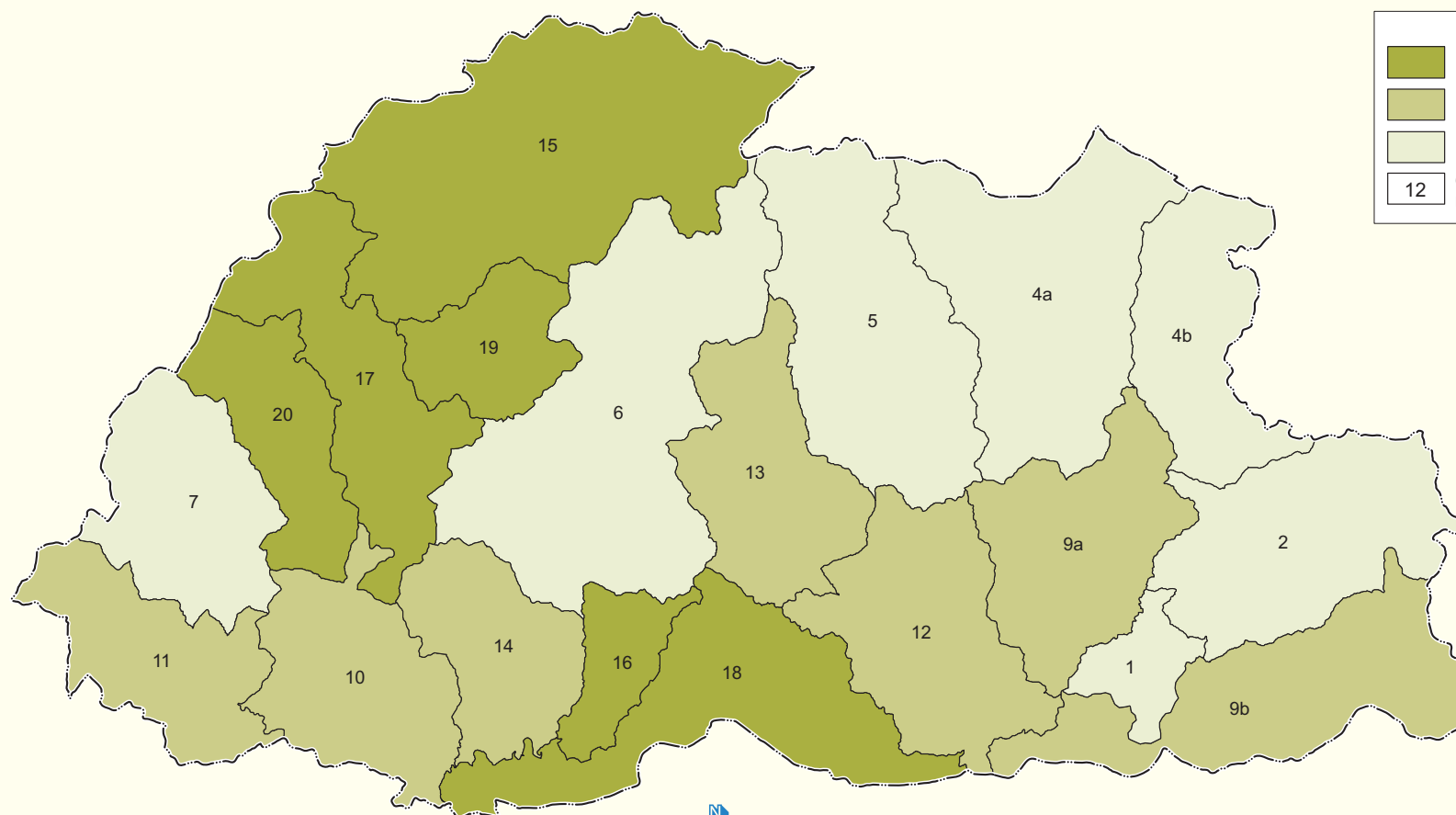
Ranking of Districts Based on Selected RNR Indicators

R 4

Overall Ranking

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Rank	
	High
	Medium
	Low
	Overall rank



Scale 1:1,500,000

0 12.5 25 50 75
Kilometres

Base Map: Department of Survey and Land Records,
Ministry of Agriculture
Data Source: RNR Statistics 2000, Ministry of Agriculture



Conclusions and Recommendations

In mountainous countries like Bhutan, people generally rely primarily on subsistence agriculture and natural resources for their livelihoods. The importance of agriculture to the national economy in Bhutan cannot be underestimated. Informed decision-making in agriculture needs to be founded on accurate and up-to-date information about the country's natural resource base and its rural economy. Synthesis and analysis of natural resources data yields the information that provides a basis for developing a policy framework, policy design, and plans and programmes.

The Royal Government of Bhutan has consistently endeavoured to improve the rural economy by emphasising increased agricultural production, and accessibility and marketing of farm products. Given the limited resources, informed planning, based on reliable data and information, is essential. Bhutan is making increasing use of relevant statistical data as a necessary input to the planning design process and is becoming increasingly aware of the need for more data. The need for more data and information in RNR management and decision making prompted Bhutan to conduct its first RNR census in 2000. The use of ICT including geo-informatics, (together known as geo-ICT) to help in the planning and management of natural resources and the environment, features prominently in the ongoing Five-Year Plan for the RNR sector.

The RNR census was an important undertaking in Bhutan. The present publication is the result of a joint attempt on the part of MoA Bhutan and ICIMOD to present the RNR census data in a more accessible form. The data were abstracted into simple indicators and presented visually in map form. This volume should help in the dissemination of RNR information to development practitioners and policy and decision makers. Within the limits of the data available, the study also demonstrates how geo-ICT tools can be applied to link data and information to policy.

The maps illustrate useful district-wise information on various aspects of Bhutan's RNR and the farming community including agricultural production, availability of land for farming, sources of income, the amount of agricultural input used for farming, and the nature of constraints faced by farming households. The visual representation of the data by district is intended to make the comparison between districts easier and is intended to give the reader an overview of the country at a glance. These maps will be most useful in monitoring of current national plan programmes and their impacts, they can also be used in the 10th Five-Year planning by using the maps to indicate areas or districts where environmental problems exist or could emerge. This information constitutes the fundamental basis for understanding the RNR sector and the need for improved agricultural production and further development.

The comments and recommendations below were developed by the study team based on the shared experience and knowledge gained in the process of compiling the present document.

- This publication was prepared using the most comprehensive data available to date, which consist mainly of the data collected by the RNR Census 2000 conducted by the Ministry of Agriculture, RGoB. Since these figures are now some five years old, readers are cautioned to take into consideration the changes that may have taken place during this time. Notwithstanding this limitation, the document contains much valuable information and its preparation has been a useful learning exercise which will make it easier to produce subsequent updated versions. Since the Ministry of Agriculture has carried out annual sample surveys since 2000, it seems feasible that this document could be updated using this new data.

- This exercise was a useful on-the-job training method to provide experience to national staff in converting data into maps. It revealed the strength of RGoB's national expertise and technologies to conduct similar exercises in future. Exercises of this type should be conducted and the results published at regular intervals as a part of the sector's information.
- In a society that has only recently appreciated the use of maps as planning and management tools, it is recommended that the MoA should circulate this publication widely for public use and to ensure maximum benefits at all levels.
- Trend data is a valuable way to monitor and evaluate the various programmes and projects that have been put into place in the RNR sector. As more annual data becomes available, it can be used to carry out trend analysis for the RNR sector. Trend data can be presented in a form similar to that used here.
- As sufficient data exist to conduct and publish maps at district level, it is highly recommended that the sector should bring out the next publication at district level to disseminate information that can be used by policy makers and planners,
- Development in one sector is often contingent on change in other sectors; for this reason, it would be interesting to see the RNR sector and its linkages from an overall development perspective. In future, basic information on other sectors such as health, education, infrastructure, energy, and communication could also be presented in a similar map form together with the RNR data. Such a holistic compilation of the country's statistical data may eventually be useful to other sectors and may prompt them to use similar methods for planning and development.
- The release of the National Population and Housing Census data is imminent. This new data will be very valuable, especially when it is analysed together with the RNR data to help enrich our understanding of the manifold aspects of development. A new volume which would include this demographic data together with RNR data would be another useful tool for government planners and development practitioners.
- Finally a word of caution the assumption is made that the RNR census provided a full description of land used for agriculture and production across the country. However, as outlined in the introduction, for various reasons this first census may in fact give a somewhat incomplete view. Thus the values should be taken as indicative rather than exact, and more useful for comparative than precise assessment of the situation.

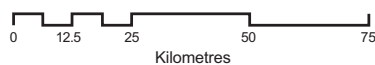
Administrative Map of Bhutan

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- Country Boundary
- District Boundary



Scale 1:1,500,000



Base Map: Department of Survey and Land Records,
Ministry of Agriculture
Data Source: RNR Statistics 2000, Ministry of Agriculture



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