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NATIONAL STATISTICS BUREAU

Towards Supporting Evidence-Based Decision Making

2022 Agriculture spatial information for paddy cultivation (2022 ASI4PC)

ABOUT THE 2022 ASI4PC

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To provide empirical evidence to support the argument on the area under paddy cultivation, the erstwhile RNR Statistics Division (RSD) under the Ministry of Agriculture and Forests conducted the estimation of area under paddy cultivation using Google Earth Observation data, 2020. Using the similar technical methods in 2022, the NSB further updated the information based on the recent google images for the whole country and conducted ground truthing for five major paddy growing dzongkhags during the “validation of the area under paddy cultivation, the case of five major paddy growing dzongkhags using three different measurement techniques—farmer self-reporting (SR), GPS measures, and Google Earth-derived (GEO) estimates” simultaneously.

The following were the specific objectives of the 2022 Agriculture spatial information for paddy cultivation (2022 ASI4PC):

- To provide empirical evidence to support the argument on the area under paddy cultivation reported through RNR surveys and censuses;
- To estimate cultivated paddy area and compare with the paddy area statistics produced through conventional statistical data collection methods;
- To establish a reliable baseline information on paddy area and production through strong area estimation for planning purposes as for estimating rice Self Sufficiency Ratio (SSR) among others using the GIS/RS technology and innovation.
- The 2022 ASI4PC will complement and integrate the conventional agriculture surveys with the use of latest GIS/RS technology to provide quality and timely RNR statistics.

DIRECTOR'S NOTE



National Statistics Bureau in its efforts towards strengthening the quality of statistics has been producing a number of thematic reports. The 2022 ASI4PC is one of many efforts in integrating the use of GIS and Remote Sensing techniques to complement and integrate with the conventional census and survey data.

I hope this brief report which is an example of how GIS and remote sensing could be used to supplement the traditional statistics will be useful to our readers.

Director

National Statistics Bureau

ACKNOWLEDGEMENT

National Statistics Bureau would like to acknowledge the support and guidance received from FAO Regional Office for Asia and the Pacific, Bangkok, Thailand. We are appreciative for their technical guidance and resource support for the smooth conduct of the 2022 ASI4PC.

METHODOLOGY

NSB updated the area under paddy cultivation using the GIS data obtained through the PAE-GIS 2020 conducted by the erstwhile RSD, Ministry of Agriculture and Forests. The data were further updated using the recent Google images. The area under cultivated paddy was digitized dzongkhag-wise and further zooming into the target areas by gewog and finally to chiwog level. This ensured complete digitization and no target areas were being missed out that are visible on image. Furthermore, the digitized cultivated paddy area data were converted to KML file to be used in the field for validation.

GROUND TRUTHING

The ground truthing and GPS data is necessary as, application of remote sensing technology has certain limitations to assess the accuracy of area under cultivated paddy derived through google earth observation data. The ground truthing or intensive field validation are conducted for geo-spatial studies where images are not clear or of recent. NSB carried out field validation on cultivated paddy area in five major paddy growing dzongkhags (Paro, Punakha, Samtse, Sarpang and Wangdue Phodrang).

The digitized cultivated paddy shape file data were uploaded in the device using android mobile Google earth pro App to be used for field validation. The observed changes in the field were recorded on the images with GPS coordinates and screen shot were taken to be referred for later updates.

STATISTICAL RESULTS

The cultivated paddy area which was recorded 40,804.95 acres in the 2020 PAE study decreased to 40,106.81 acres in 2022 based on the 2022 ASI4PC. This was 1.71 percent (less 698 acres) drop in 2022 than in 2020.

Across dzongkhags, Sarpang recorded the highest decrease cultivated paddy area of 300 acres, followed by Samtse with 175 acres and Wangdue Phodrang with 150 acres. The reduction in the cultivated paddy in Sarpang and Samtse were mainly from Gelegphu and Tashichhoeling gewogs partly due to loss of prime paddy area to the urban development.

Punakha dzongkhag, on the other hand recorded the largest cultivable paddy area holding of 6,291.23 acres, followed by Samtse dzongkhag with 5,301.40 acres and Wangdue Phodrang with 4,772.61 acres. The lowest cultivated paddy area was recorded for Pema Gatshel dzongkhag with 19.34 acres, Haa with 99.7 acres and Gasa with 175.91 acres. Table 1 provides the summary statistics of the area under paddy cultivated in 2022 and a detailed individual dzongkhag and by gewog for the area under paddy cultivation changes are provided in the maps .

The results may be taken as indicative for now as the reduction in the cultivated paddy area depends on many other factors. For example, some of the satellite images used in the current study were not recent and those images available were of different dates. For some dzongkhags, the cultivated area under paddy cultivation were direct visual interpretation and digitization.

RECOMMENDATION

The 2022 ASI4PC proposes the following recommendations for improvement and

strengthening of area statistics for Paddy in future:

- A similar time period study is recommended to determine the actual change or reduction in the area under paddy cultivation;
- A large scale in-depth study may be conducted to estimate and validate the area under paddy cultivation and similar study extended to other priority crops to validate the production data;
- To improve the precision of the estimates of the area under paddy cultivation, ground truthing is highly recommended; and
- The field validation exercises need to be carried out in the months of September to October during the paddy harvesting seasons for many reasons. The conduct of field validation during the harvesting season gives the validation team with an advantage to identify (visual) the area under paddy cultivation from distance.

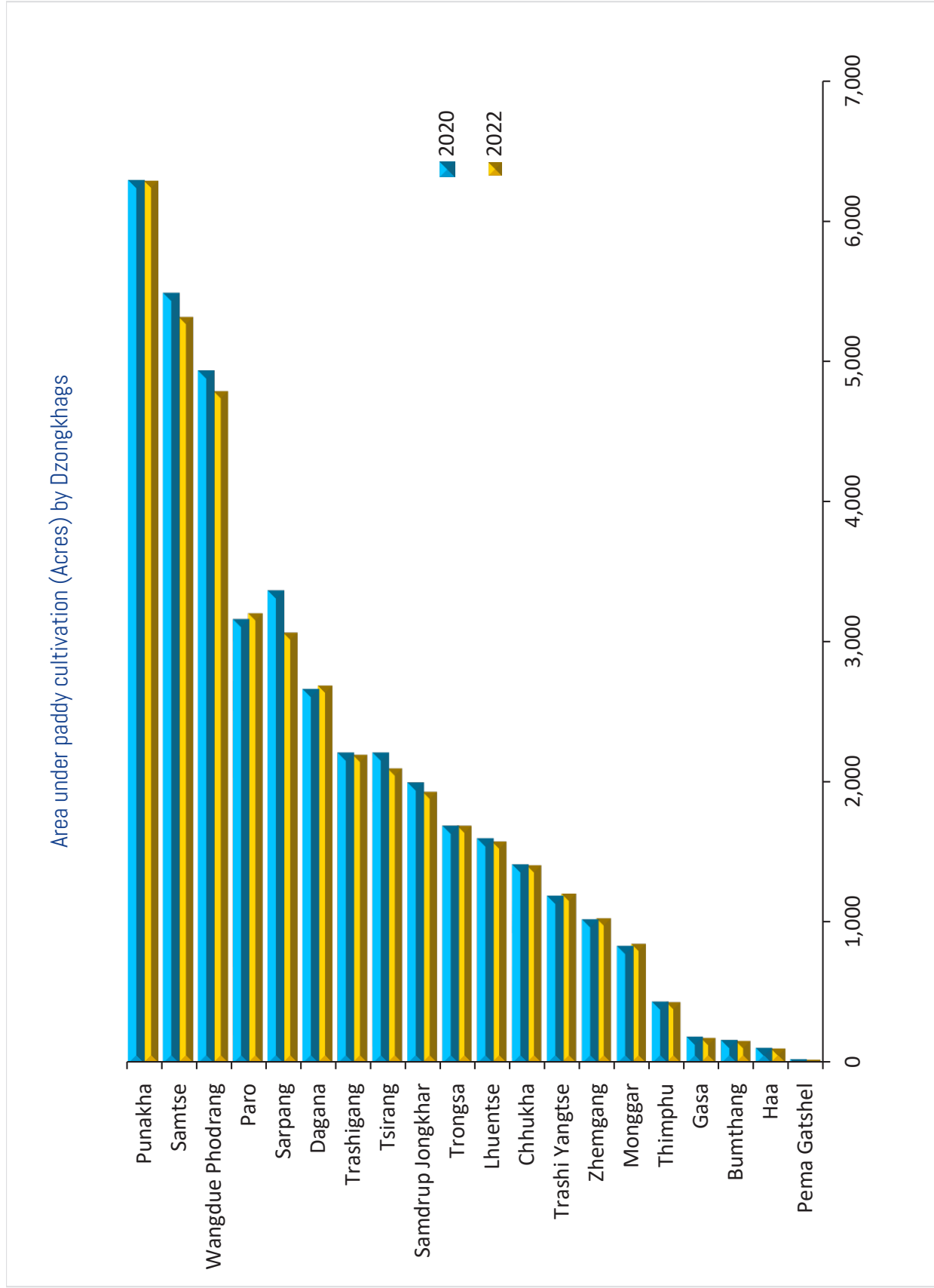
LIMITATIONS

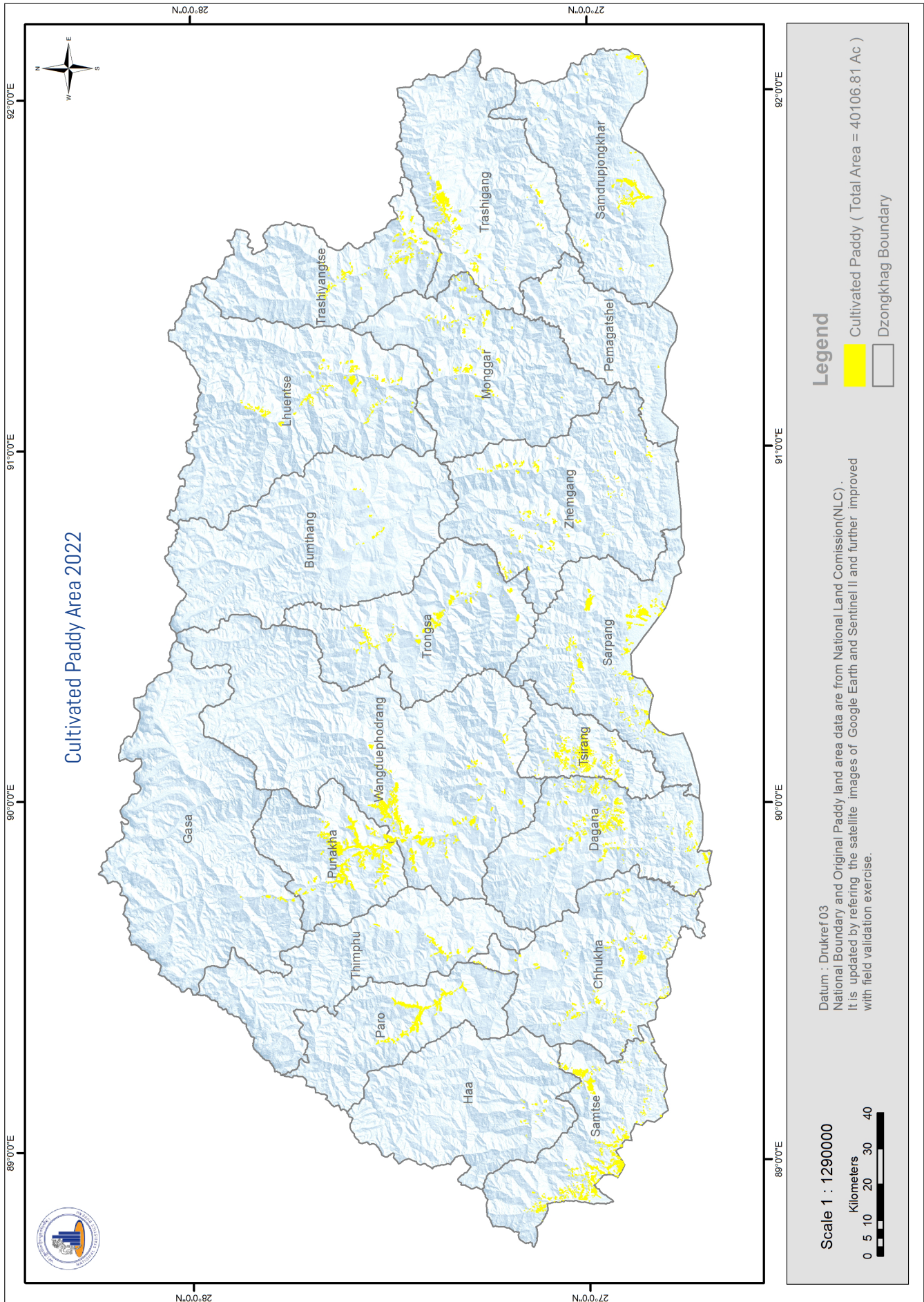
Like any other studies, the 2022 ASI4PC also has the following limitations:

- Few areas under paddy cultivation may have missed as the plots are smaller in nature and paddy holder do mixed cropping in small parcels;
- The precision of the area estimated for paddy cultivation also largely depends on the availability of updated Google images and the images for some parts of the country were found old and not updated to the recent times; and
- Due to resource constraint, the intensive ground truthing or field validation for whole country was not possible.

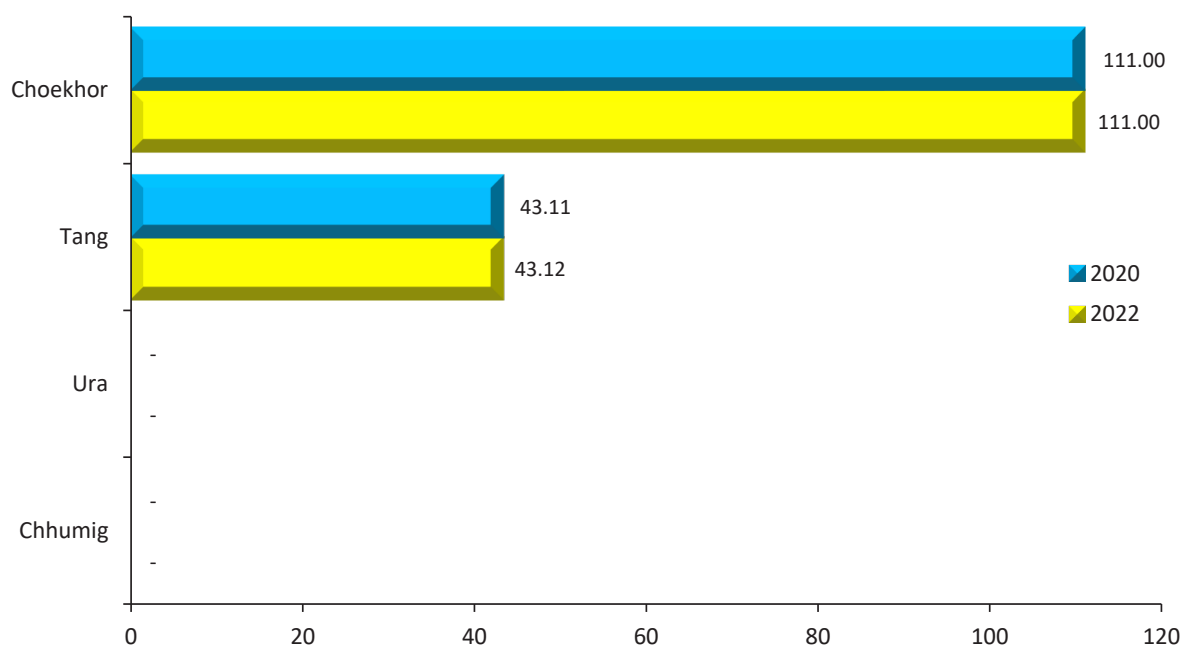
TABLE I: ESTIMATED AREA UNDER PADDY CULTIVATION BASED ON THE 2022 ASI4PC

Dzongkhag	2020	2022	Difference in Area	% reduction
Bumthang	154.11	154.12	0.01	0.0%
Chhukha	1,404.94	1,402.60	(2.34)	-0.2%
Dagana	2,654.42	2,680.27	25.85	1.0%
Gasa	175.99	175.91	(0.08)	0.0%
Haa	98.03	99.77	1.74	1.8%
Lhuentse	1,589.61	1,572.45	(17.16)	-1.1%
Monggar	824.16	844.35	29.19	2.4%
Paro	3,151.93	3,193.63	41.70	1.3%
Pema Gatshel	17.01	19.34	2.33	13.7%
Punakha	6,287.39	6,291.23	3.84	0.1%
Samdrup Jongkhar	1,988.27	1,291.23	(63.72)	-3.2%
Samtse	5,476.33	5,301.40	(174.93)	-3.2%
Sarpang	3,357.11	3,057.11	(300.00)	-8.9%
Thimphu	427.18	429.51	2.33	0.5%
Trashigang	2,200.64	2,188.12	(12.52)	-0.6%
Trashigang	1,180.07	1,199.81	19.74	1.7%
Trongsa	1,680.02	1,684.20	4.18	0.2%
Tsirang	2,201.32	2,090.71	(110.61)	-5.0%
Wangdue Phodrang	4,922.69	4,772.61	(150.08)	-3.0%
Zhemgang	1,013.73	1,025.13	11.40	1.1%
Total	40,804.95	40,106.81	698.14	-1.7%

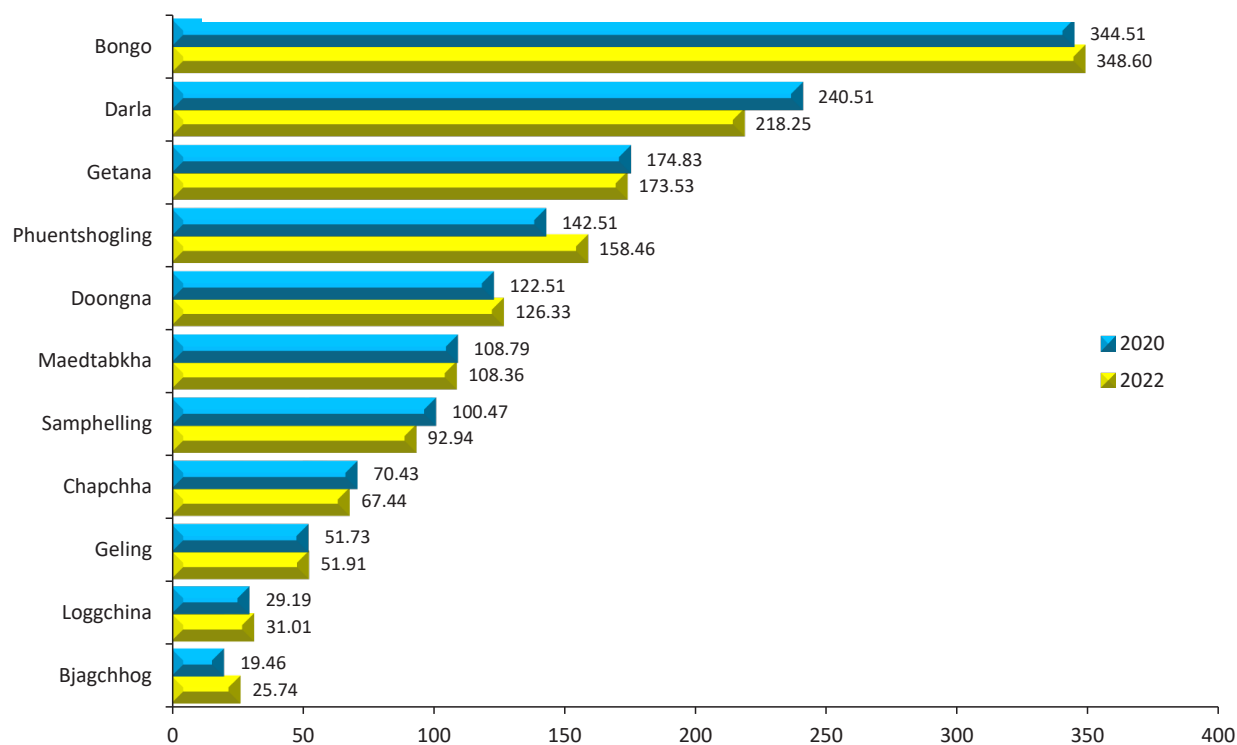




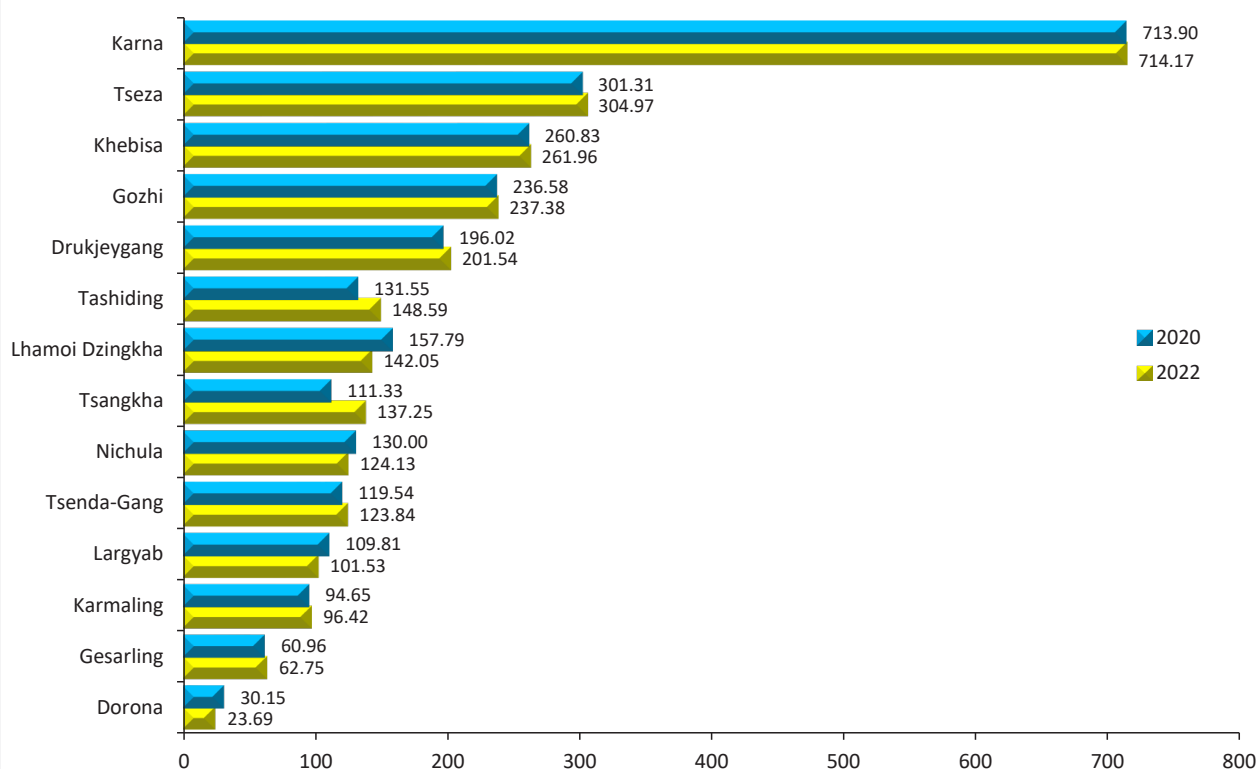
Area under paddy cultivation (Acres) by Gewog in Bumthang



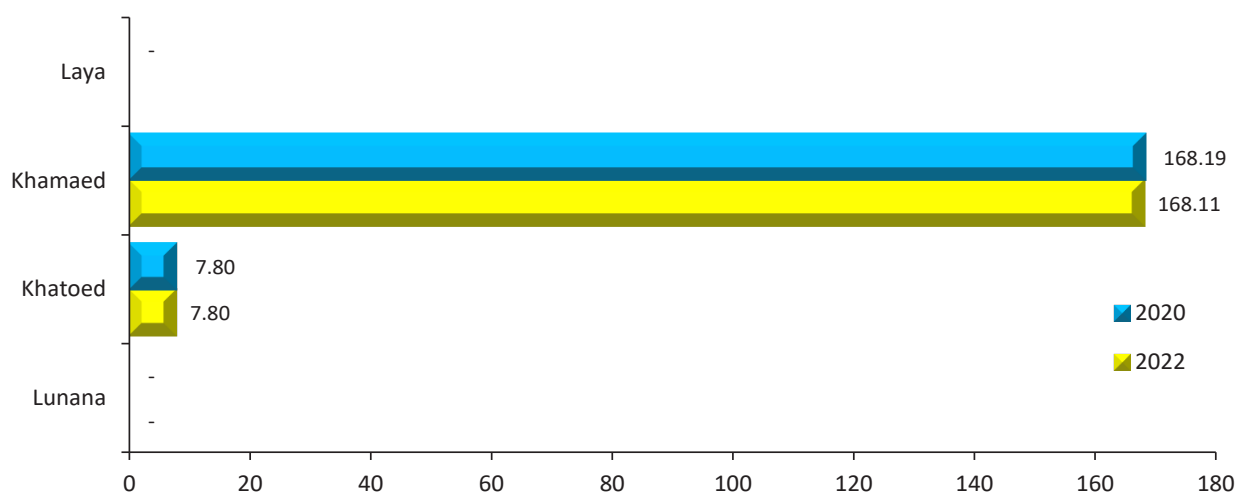
Area under paddy cultivation (Acres) by Gewog in Chhukha



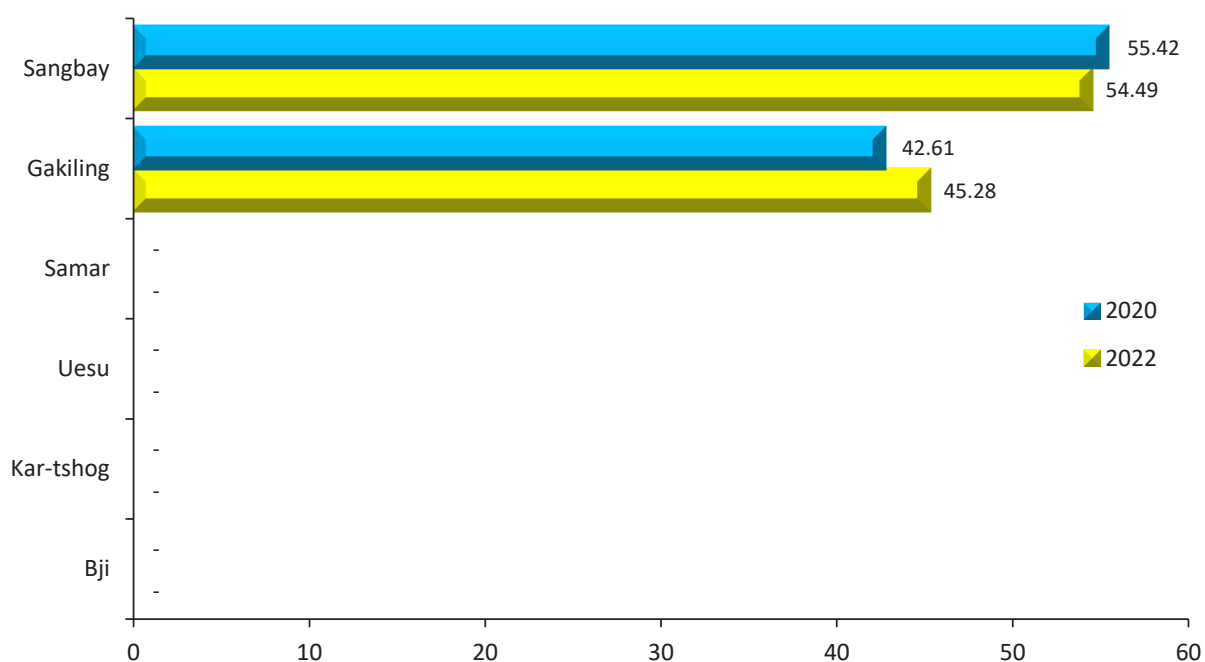
Area under paddy cultivation (Acres) by Gewog in Dagana



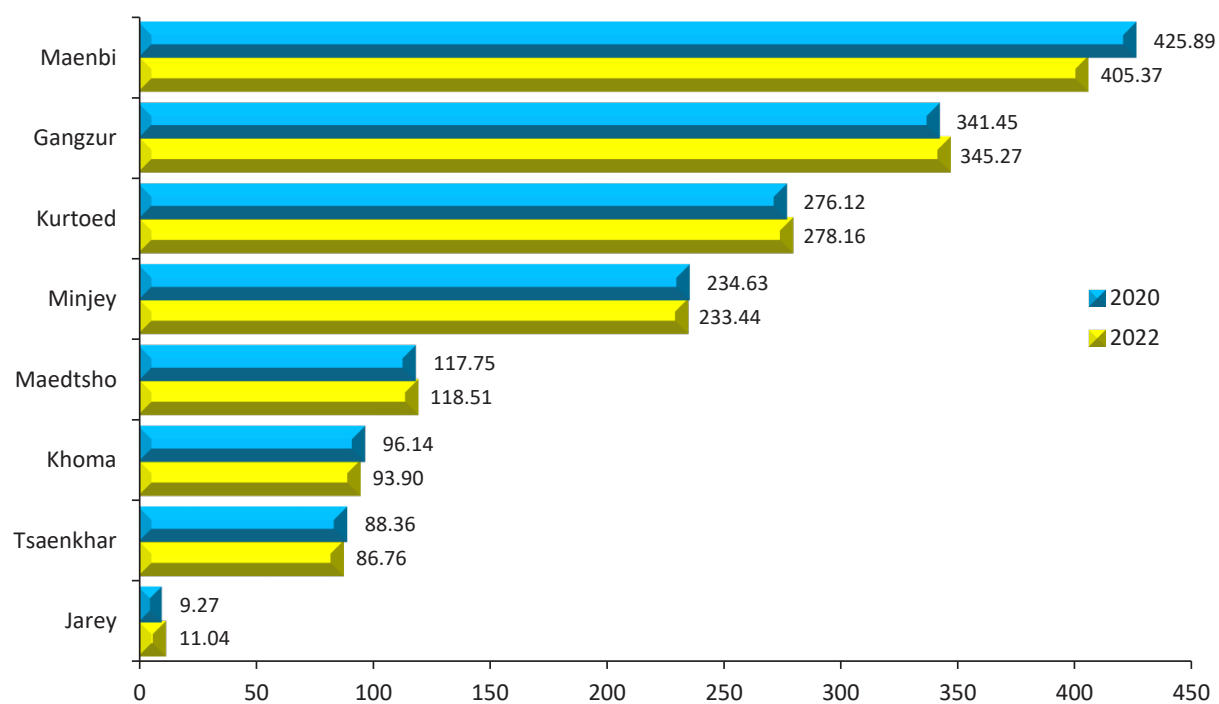
Area under paddy cultivation (Acres) by Gewog in Gasu



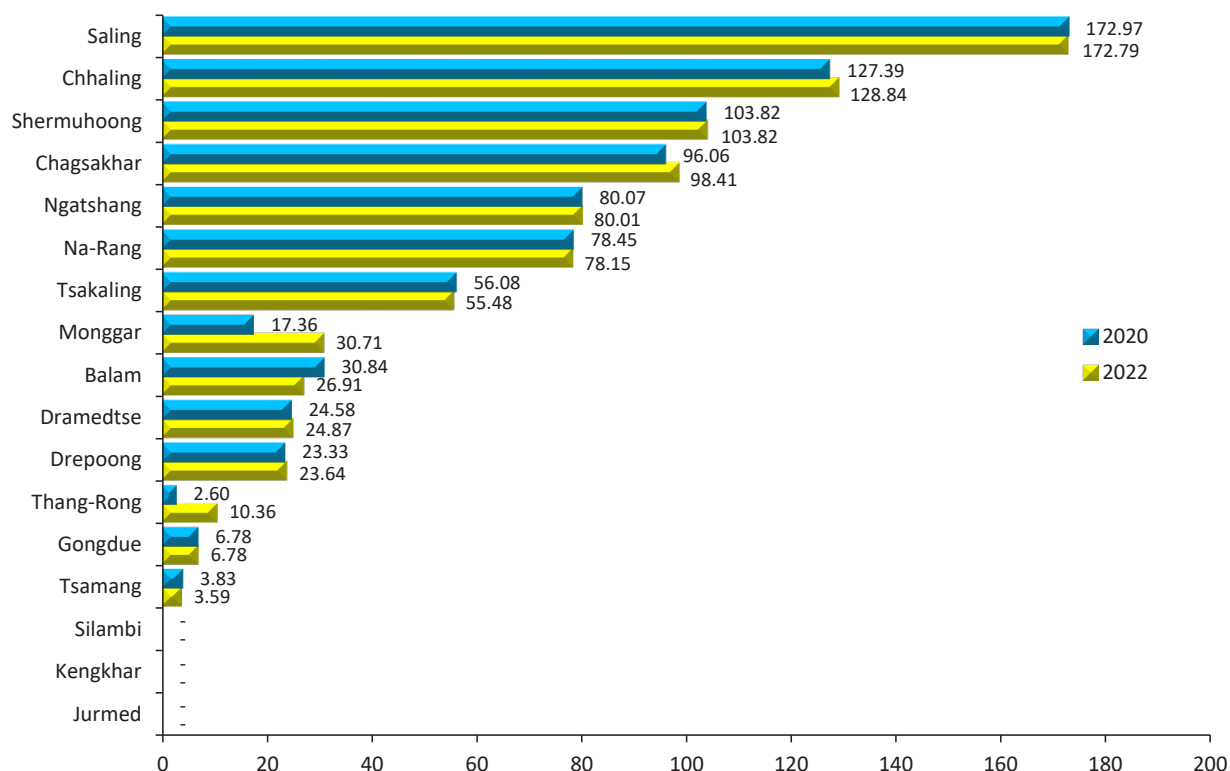
Area under paddy cultivation (Acres) by Gewog in Haa



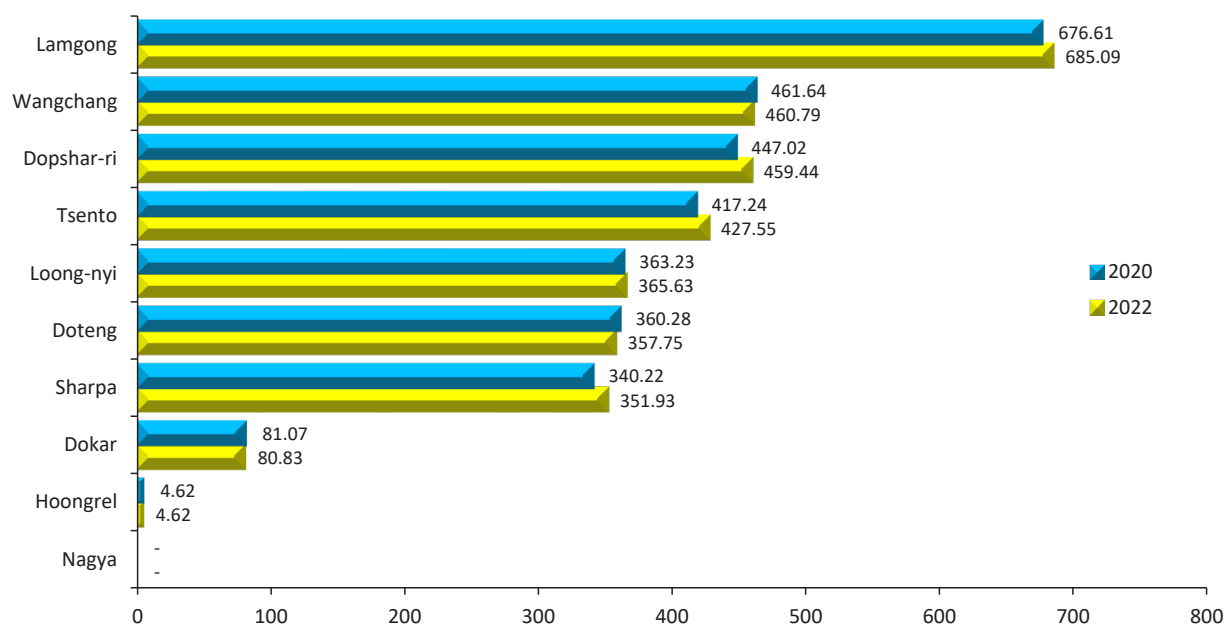
Area under paddy cultivation (Acres) by Gewog in Lhuentse



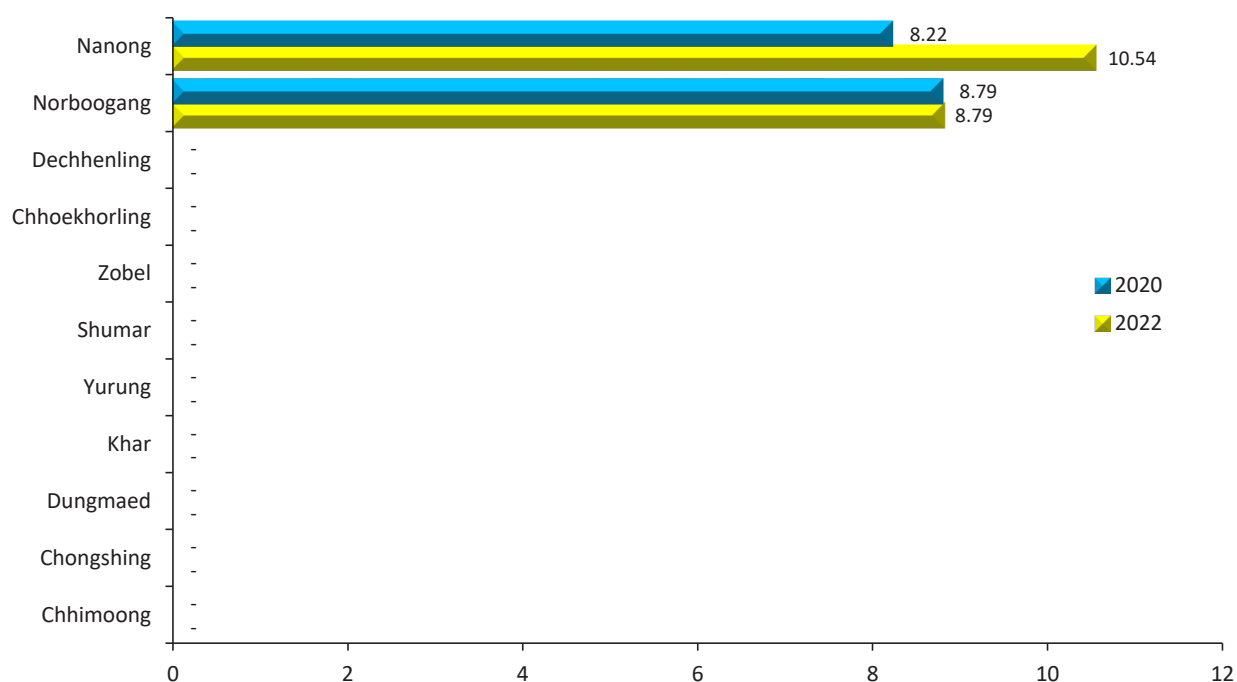
Area under paddy cultivation (Acres) by Gewog in Monggar



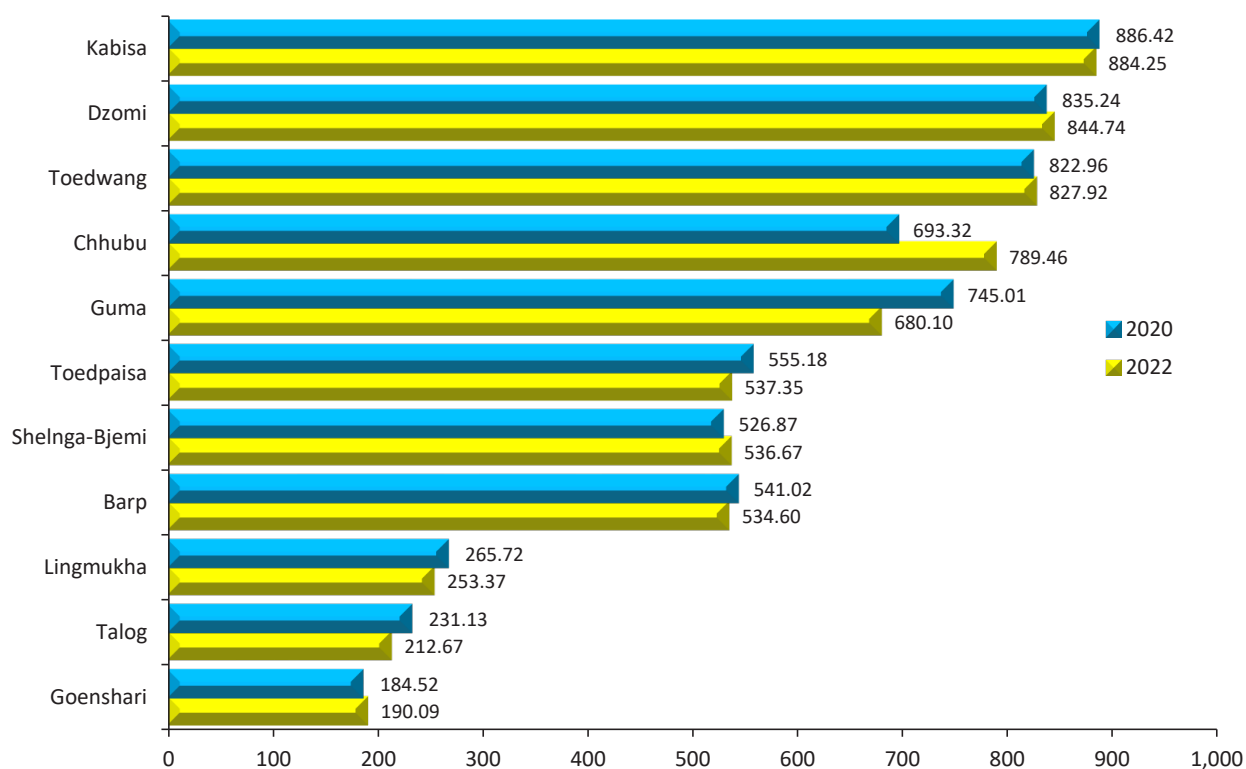
Area under paddy cultivation (Acres) by Gewog in Paro



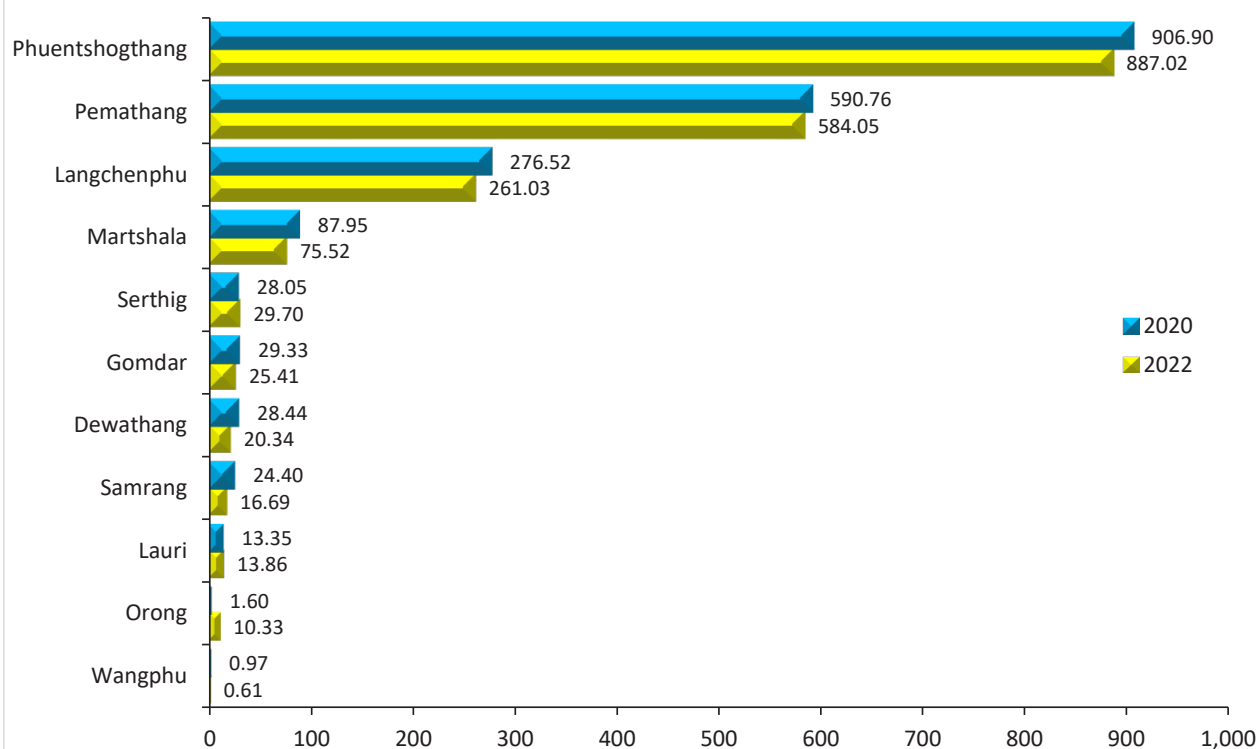
Area under paddy cultivation (Acres) by Gewog in Pema Gatshel



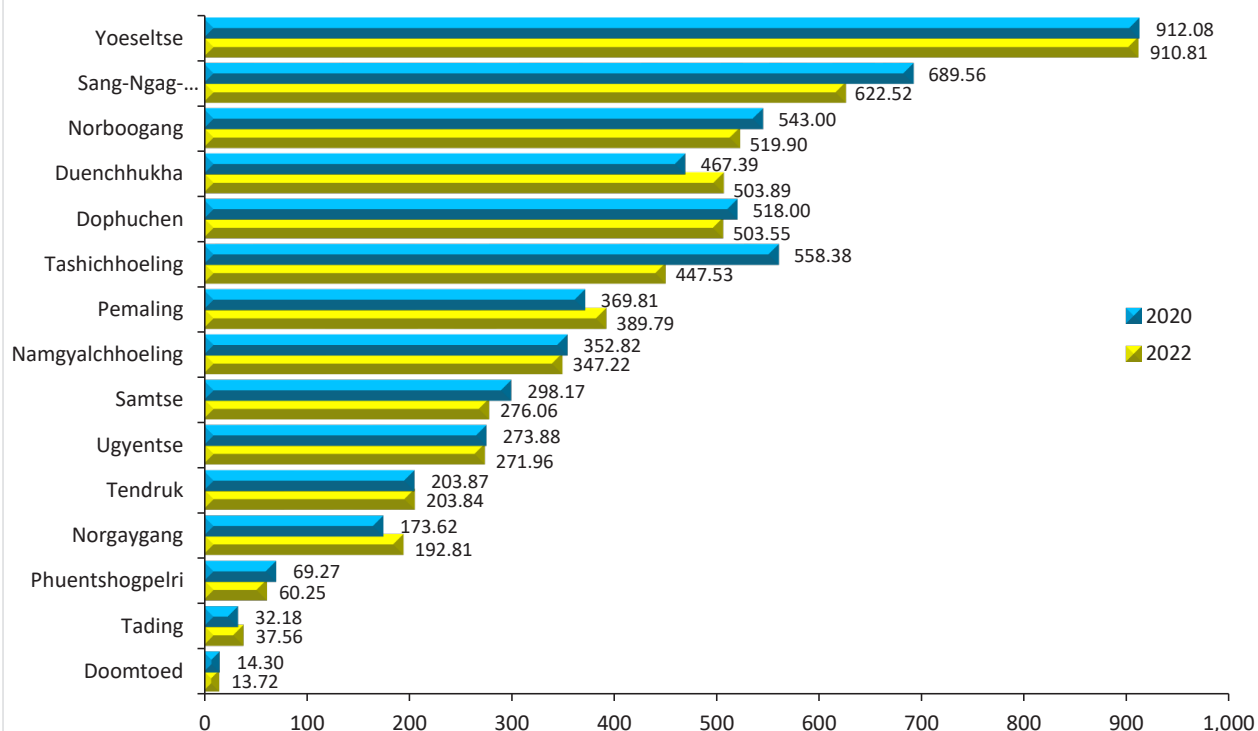
Area under paddy cultivation (Acres) by Gewog in Punakha



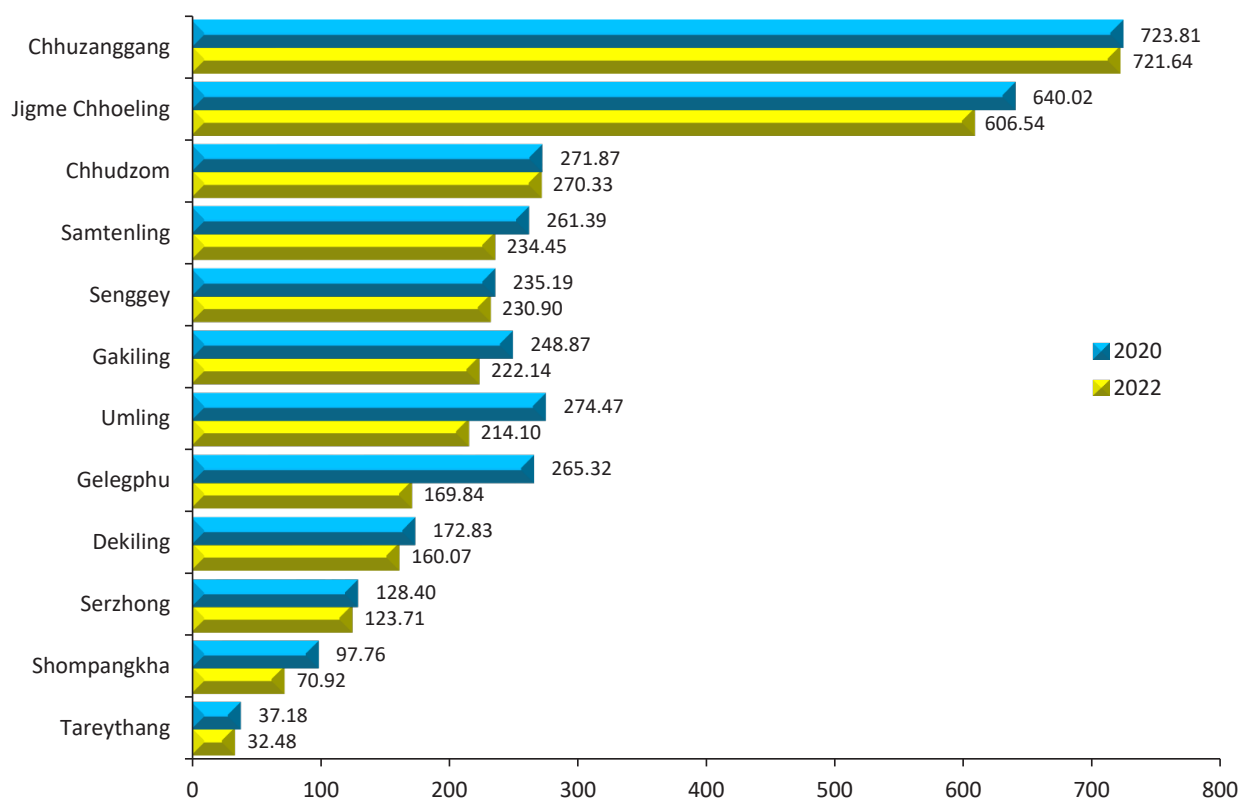
Area under paddy cultivation (Acres) by Gewog in Samdrup Jongkhar



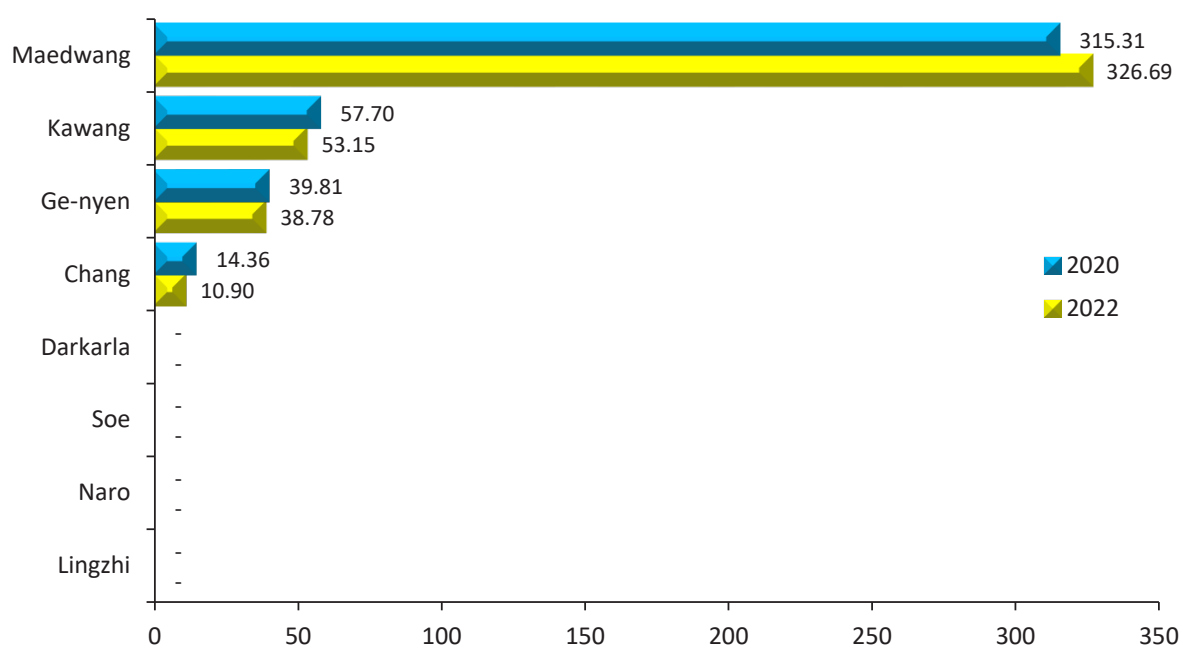
Area under paddy cultivation (Acres) by Gewog in Samtse



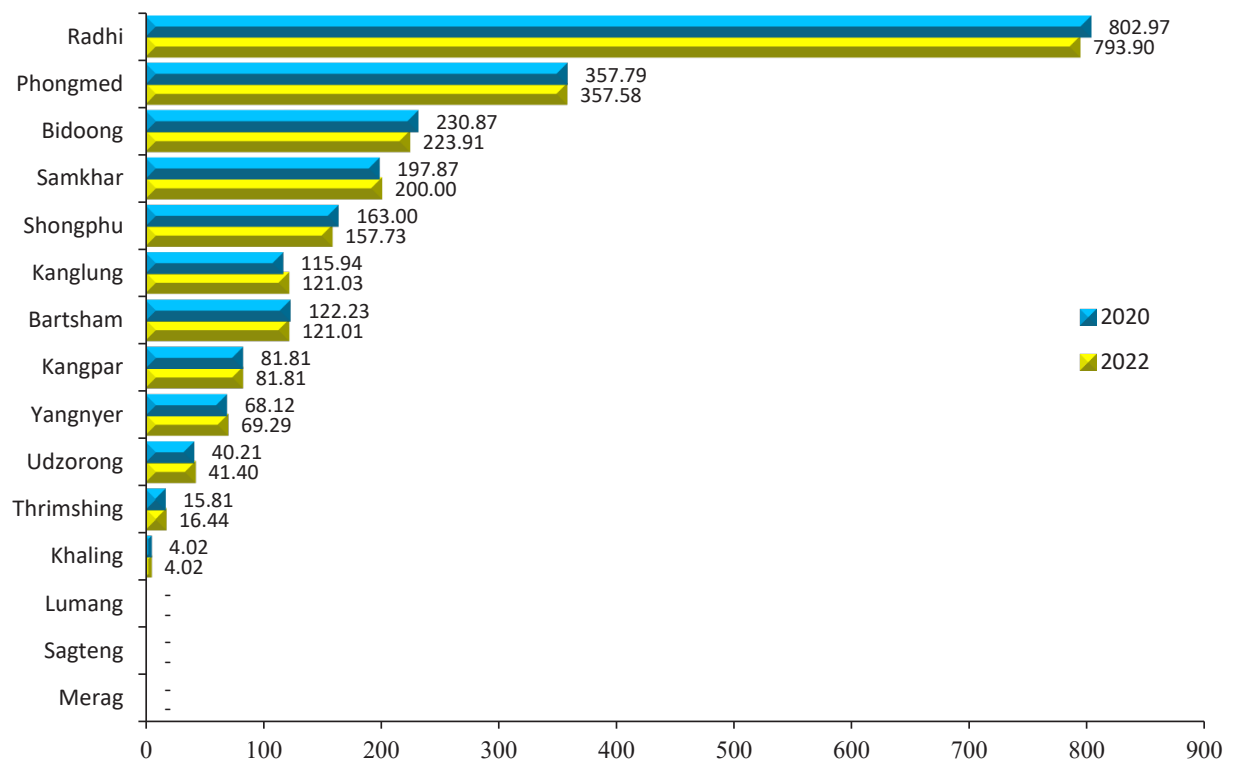
Area under paddy cultivation (Acres) by Gewog in Sarpang



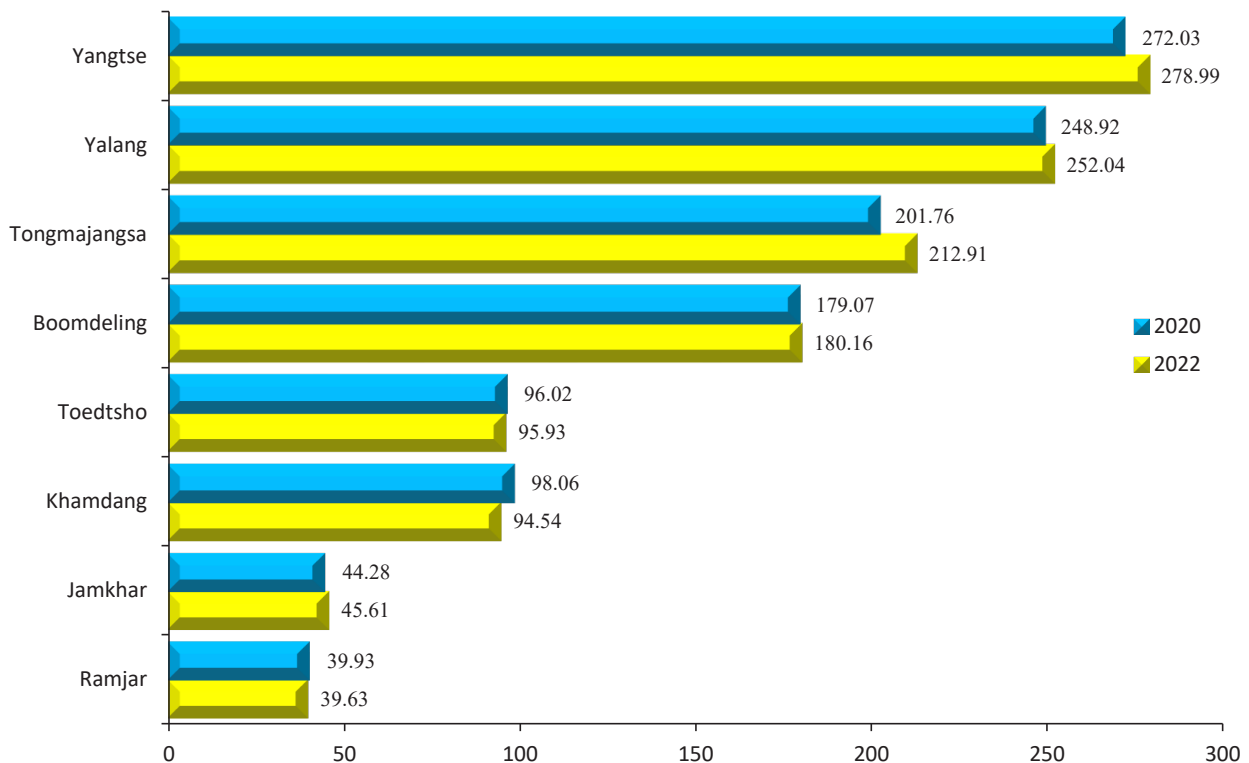
Area under paddy cultivation (Acres) by Gewog in Thimphu



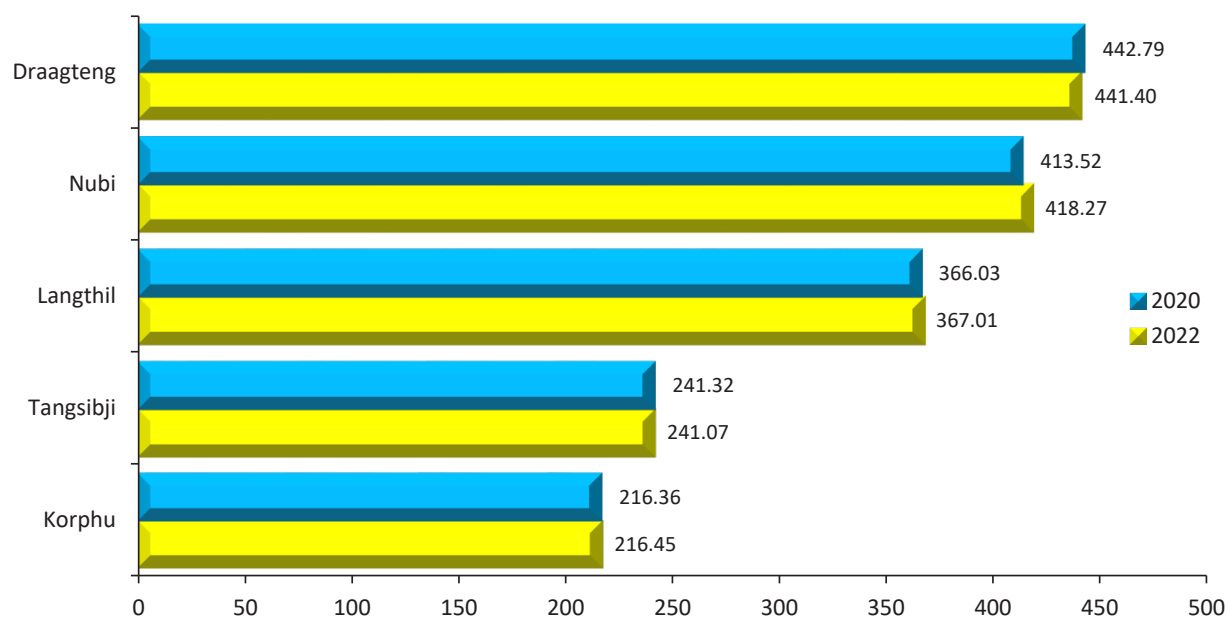
Area under paddy cultivation (Acres) by Gewog in Trashigang



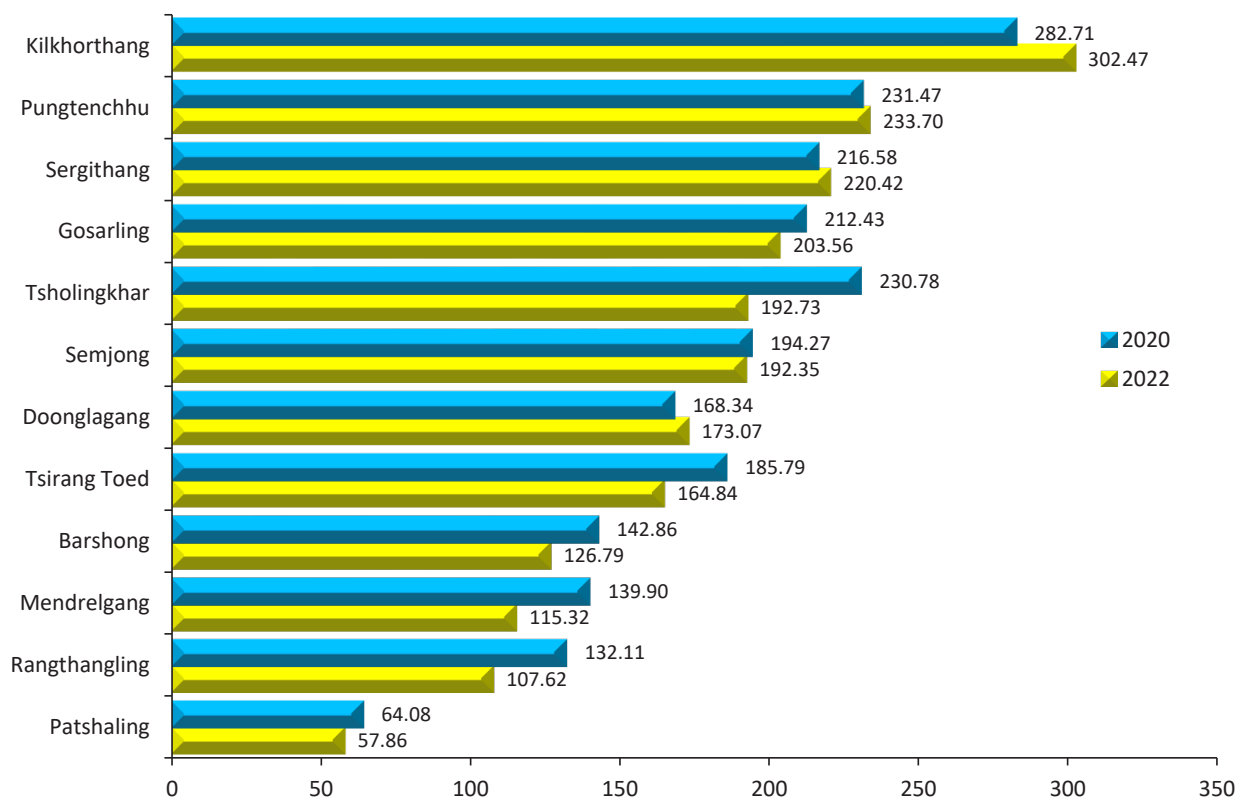
Area under paddy cultivation (Acres) by Gewog in Trashi Yangtse



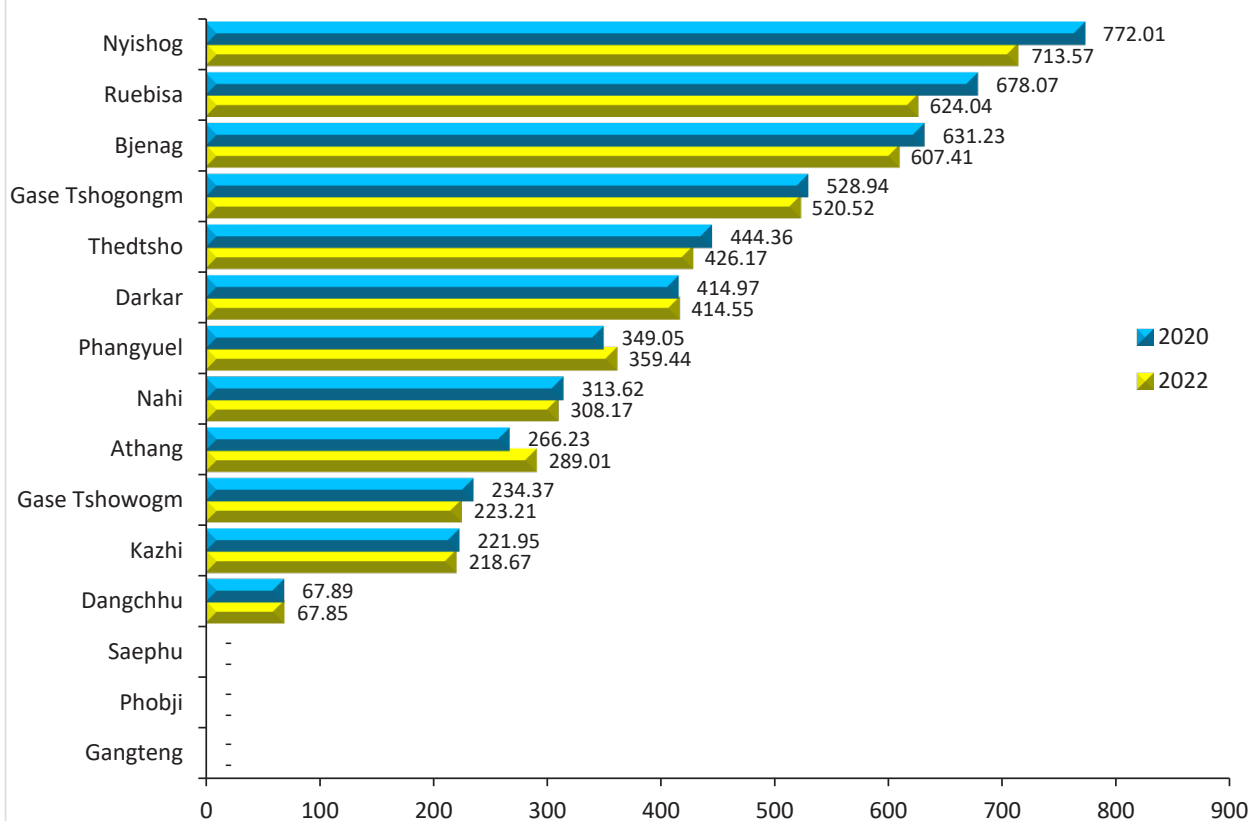
Area under paddy cultivation (Acres) by Gewog in Trongsa



Area under paddy cultivation (Acres) by Gewog in Tsirang



Area under paddy cultivation (Acres) by Gewog in Wangdue Phodrang



Area under paddy cultivation (Acres) by Gewog in Zhemgang

