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United States Department of Agriculture (USDA)
International Operational Agriculture Monitoring Program

USDA Foreign Agricultural Service

Pakistan: Crop Progress Report

MY 2010/11

December/ Start of Season Summary **January 4, 2009**

(1) Pakistan is a predominantly arid agrarian country with abundant arable land lying within the Indus River basin. The Indus Basin is a large alluvial plain running from north to south created by the Indus River and its tributaries, covering approximately 40 percent of the country's geographic area. The agricultural sector in Pakistan accounts for 43 percent of the country's labor force and over 20 percent of its gross domestic product (GDP). There are two agricultural seasons in Pakistan named "kharif "and "rabi." The kharif season refers to the summer growing period from May to November, with the major crops cultivated being rice, corn and cotton. The rabi or winter growing season runs from December through April, with the major crops being wheat, barley and millet. Farming activities are mostly subsistence in nature with a core emphasis being on food crop production (70% of total cropped area). Wheat is the major staple food grain crop in Pakistan, contributing about 45 percent of the daily caloric consumption of the population. Wheat is also a critical commodity in terms of total contribution to national food security[1]. The national wheat crop occupies two-thirds of the total agricultural area cultivated in Pakistan, averaging 8.3 million hectares per annum. The most important wheat producing area is in Punjab province, where about 70 percent of the national wheat crop is grown under irrigated conditions. Rice is the second most important food grain crop, accounting for about 6 percent of the daily caloric intake. The national rice crop is predominantly rainfed and it is planted from May-June during the kharif season. The annual rice harvest generally occurs from October-December. Production of rice has been fairly stable in the past five years, averaging 5.8 million tons (milled rice basis). Punjab is the major rice growing area.

(2) The current outlook for national wheat production in the new MY 2010/11 growing season is uncertain at this early stage and will be dependant on adequate surface water irrigation supplies in the key production areas of Punjab and Sindh provinces during January and February – coinciding with the key growth stages for wheat. With over 86 percent of Pakistan's wheat crop area being irrigated (over 90% of total wheat production), annual production prospects are more stable than in its neighbor Afghanistan. The key constraint to production is generally the timing and availability of the irrigation water supply, and the efficiency of water use on-farm. Approximately 90 percent of the water supply in the Upper Indus River Basin comes from remote glaciers of the Himalayan and Karakorum mountain ranges, which border China and India, and the Hindu Kush, which borders Afghanistan. The remainder comes from seasonal rainfall, especially during the monsoon season from July to September. Water recharge to the river systems and reservoirs through annual rainfall and

[1] USAID. Pakistan Food and Agriculture Report. March, 2009.

snow accumulation has been adequate to better-than-normal over the past few years. This generally favorable water supply should provide ample irrigation supplies for the beginning of this year's (MY 2010/11) wheat crop. The two most important wheat producing provinces are Punjab and Sindh, which account for 76 percent and 14 percent of total national wheat output respectively. Baluchistan and Northwest Frontier provinces are more mountainous and lie mostly outside of the Indus Basin. As a result they have less irrigation supplies and much lower cultivated agricultural acreage. Baluchistan and Northwest Frontier Province are minor wheat producing provinces, normally accounting for approximately 4 percent and 6 percent of national grain production respectively (Figure 1).

(3) The planting window for Pakistan's annual wheat crop generally extends from October through early December, though actual planting dates will vary regionally depending on available water supply, climatic conditions, and wheat variety (Figure 2). Remotely sensed evidence of wheat emergence via satellite imagery can be obtained as early as the end of December, with definitive evidence of wheat development by mid-January (Figure 3). Satellite vegetation index data (NDVI) time series analysis over agricultural areas in the four wheat production provinces (Figures 4 – 7) all show duel periods of peak crop vegetation development coinciding with the two annual growing seasons - Rabi (November-April) and Kharif (June-October). Peak wheat vegetation development in Pakistan (between wheat flowering stage and grain filling) usually occurs from late March to early February, with the harvesting period ranging from April to June.

(4) The majority of Pakistan is arid or semi-arid, with the southern portion of Punjab and the majority of Sindh and Baluchistan all receiving less than 250 mm of annual rainfall. Higher precipitation does occur along the country's mountain ranges, with the highest rainfall (>1000 mm) occurring in the mountains of the Northwest Frontier Province. There are two sources of rainfall in Pakistan, southwest monsoon rains which occur from July to September and the Western Depression which occurs December to March. Winter rainfall from the Western Depression is usually evident in monthly average rainfall over Pakistan's western highlands. But the Indus Basin, where over 90 percent of the rabi season wheat crop is produced, generally receives minimal rainfall during this time of year (Figure 8).

Winter Grains – Background

(5) Rainfall conditions during the previous two wheat growing seasons (MY 2008/09 and MY 2009/10) were higher than normal over both Punjab and Sindh provinces. Though crop production in these provinces is irrigated, additional water availability in the form of direct rainfall can increase the crop's yield potential as well as help to recharge water resources (Figure 9). With over 80 percent of all wheat production in Pakistan occurring on irrigated fields in the Indus Basin, the constant supply of surface water flowing through the valley is extremely important. Five major rivers make up the bulk of the hydrologic system in Pakistan's alluvial plain, namely the Indus River, Satluj River, Ravi River, Chenab River, and Jhalum River (Figure 10). Additional tributaries flow into and feed the system, one of the larger of which is the Kabul River flowing from Afghanistan into the Indus River. The upper reaches and tributaries of the Indus have their headwaters in the Pakistani, Chinese, and Indian Himalayas; fed by snowmelt from six Himalayan glaciers that provide 90 percent of

the river's capacity. Three major dams and their accompanying reservoirs help to provide the majority of the nations irrigation supply, including Tarbela Dam on the Indus river, Mangla Dam on the Jhalum River, and Warsak Dam on the Kabul River. The Tarbela Reservoir is located on the shared border of Punjab and NWFP and provides canal irrigation water for 50 percent of Pakistan's agricultural land. Reservoir recharge from summer monsoon rains (July to September) were favorable within the Tarbela catchment this year, with water surface area swelling to one and a half times the May 2009 levels (Figure 11). However, recharge over the Mangla Reservoir during the same timeframe was less favorable - with current surface area show a 27 percent reduction from May 2009 levels (Figure 12). Both reservoir maps are showing change in water levels between May 2009 and November 2009, with the light blue color indicating May 2009 baseline levels. The current shortfall in water supply in the Mangla Reservoir could imply there may be some restrictions on irrigation availability in the northeastern section of Punjab this winter. However, it is also possible that the Mangla shortages could be compensated for in some wheat growing areas by the abundant water supply from the Tarbela Reservoir. Pakistan's irrigation infrastructure transfers water supplies through a series of private and government canals, tubewells, and groundwater wells. An estimated 34 percent of irrigation supplies are pumped from groundwater.

(6) National wheat area, yield, and production statistics for Pakistan over the last 10 years are displayed in Figure 13. National wheat production has averaged 20.9 million metric tons, with a record 24.0 million ton crop achieved last year (MY 2009/10). Total domestic wheat consumption also averaged 20.9 million metric tons over the past 10 years, with national wheat supply exceeding demand in only five out of the past 10 years.

Winter Grains Current Season

(7) Season-to-date rainfall has been particularly low this year when compared to last year (MY 2009/10) and the long-term average (Figure 14). Highest overall rainfall occurred in the northern mountainous regions of the Northwest Frontier Province (NWFP), in the northwest portion of Punjab Province and along the Afghanistan border. The October and November rainfall pattern benefitted the NWFP with better than normal conditions; however the major wheat producing provinces of Punjab and Sindh received well below normal precipitation since the beginning of the wheat planting season (Figure 15). Despite the reliance on irrigation supplies for winter crop production in Punjab and Sindh, rainfall during the September-November period is important to provide beneficial planting and germination conditions for both irrigated and rainfed wheat crops. Rainfall during this time also helps to conserve irrigation supplies for later use in the winter growing season.

(8) Satellite-derived vegetation index (NDVI) analysis, comparing the current season against the previous 6-year average indicates that overall wheat crop development is slightly behind normal in all major wheat growing regions (Figure 17). The previous 5 years, which are calculated in the 6-year average, coincidentally included the five largest wheat crops produced in the country since 1960. In addition, a vegetative index analysis comparing current crop conditions to last year (MY 2009/10) also indicates that the vast majority of wheat producing areas are exhibiting slightly less favorable development than last year. The exceptions include a small number of districts in northeast Punjab as well as along the Sindh-

Baluchistan border (Figures 18 and 19). It is important to note that the differences in crop development displayed by vegetation index data at this time of year represent only minimal change, and should not be cause for alarm. The lack of rainfall during this year's early planting season (October and November) could have delayed normal sowing operations and slowed early crop emergence when compared to more favorable conditions from previous years. Continued monitoring of the MY 2010/11 crop in coming months will reveal whether this pattern continues or is reversed when primary growth stages occur in the wheat crop.

(9) Winter snowpack in the northern mountains of Pakistan represents an important source of ground and surface water recharge during the spring and summer months as snowmelt feeds streams and tributaries of the major rivers in the Indus Basin system. Current winter snowpack, as of December 20, 2009 is relatively average in both depth and area, with higher than normal snow depth in Hindu Kush mountain range over the northern portion of Northwest Frontier Province along the Afghanistan border (Figure 20). Estimated snow-water equivalent for Pakistan is average for this time of year, winter snow pack will continue to accumulate in northern Pakistan reaching a peak around mid-February.

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Percent of National Wheat Production by Agricultural Region

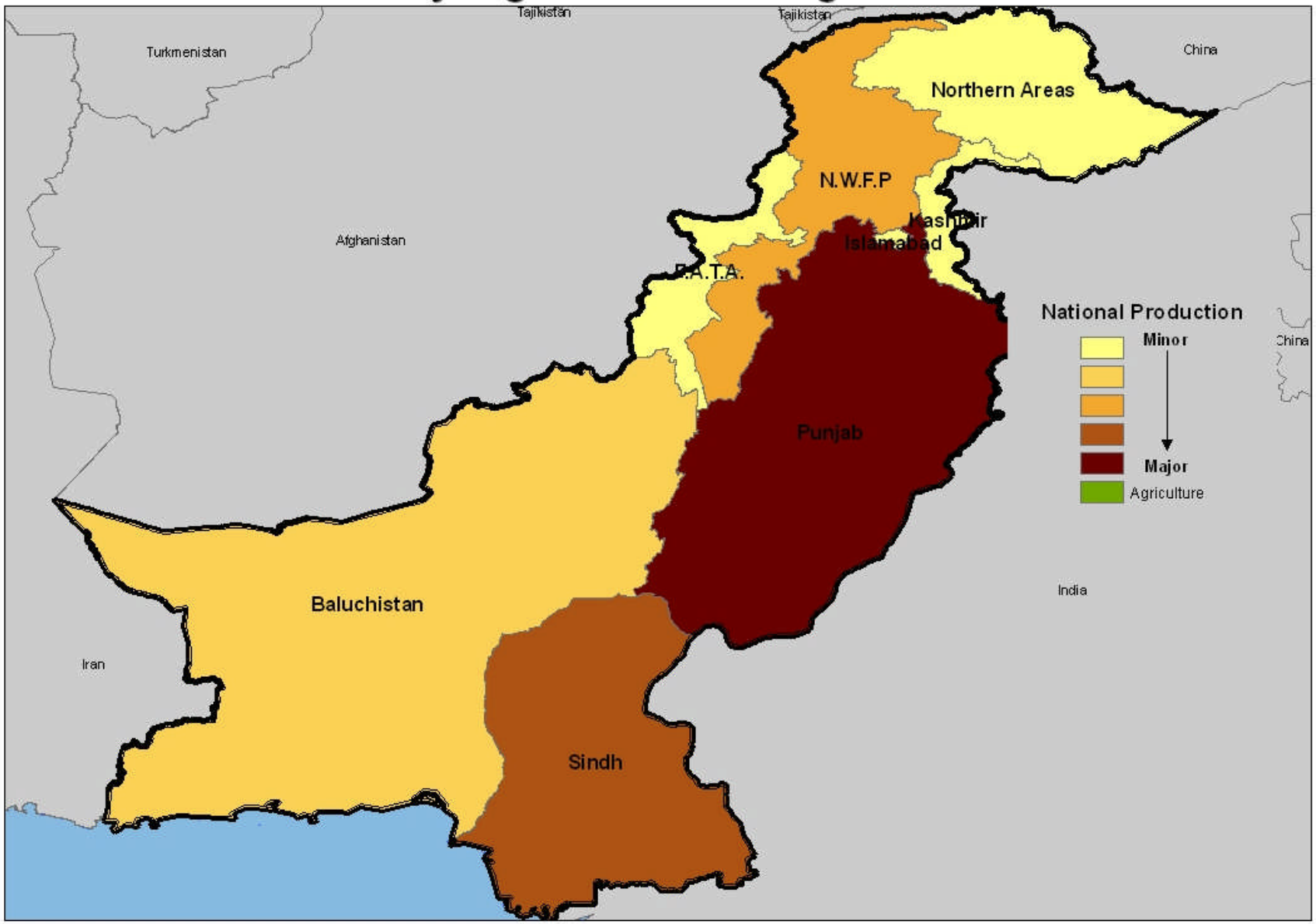

Figure 1. Percent of national wheat production broken down by province.

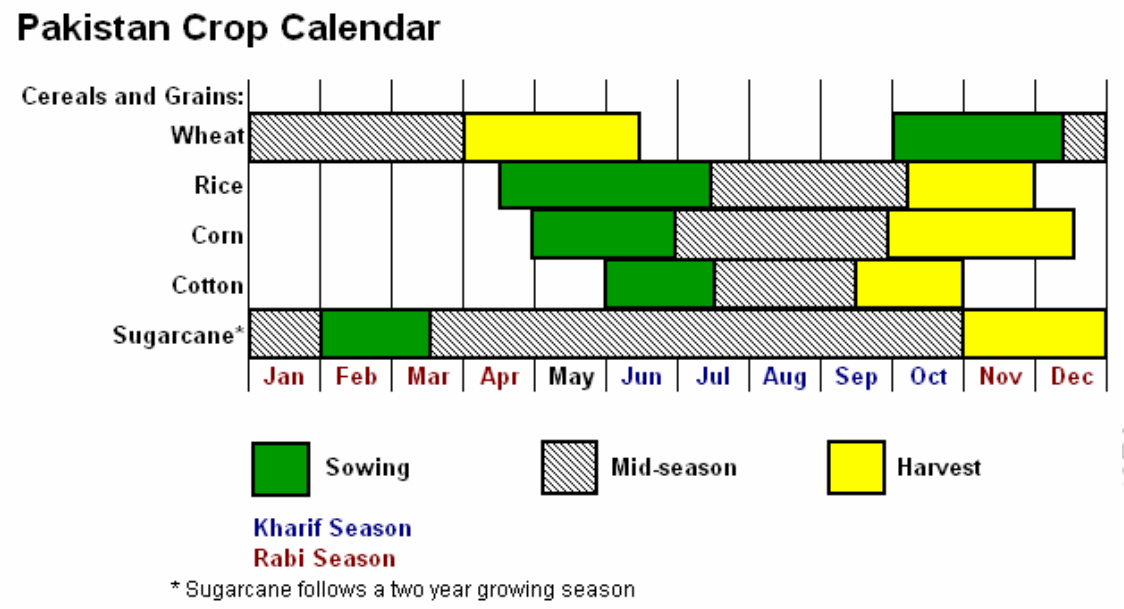

Figure 2. Pakistan crop calendar highlighting major crops grown during Rabi (Nov. – Apr.) and Kharif (June – Oct.) growing seasons. Calendar represents major production regions, timing of planting and harvest may vary regionally.

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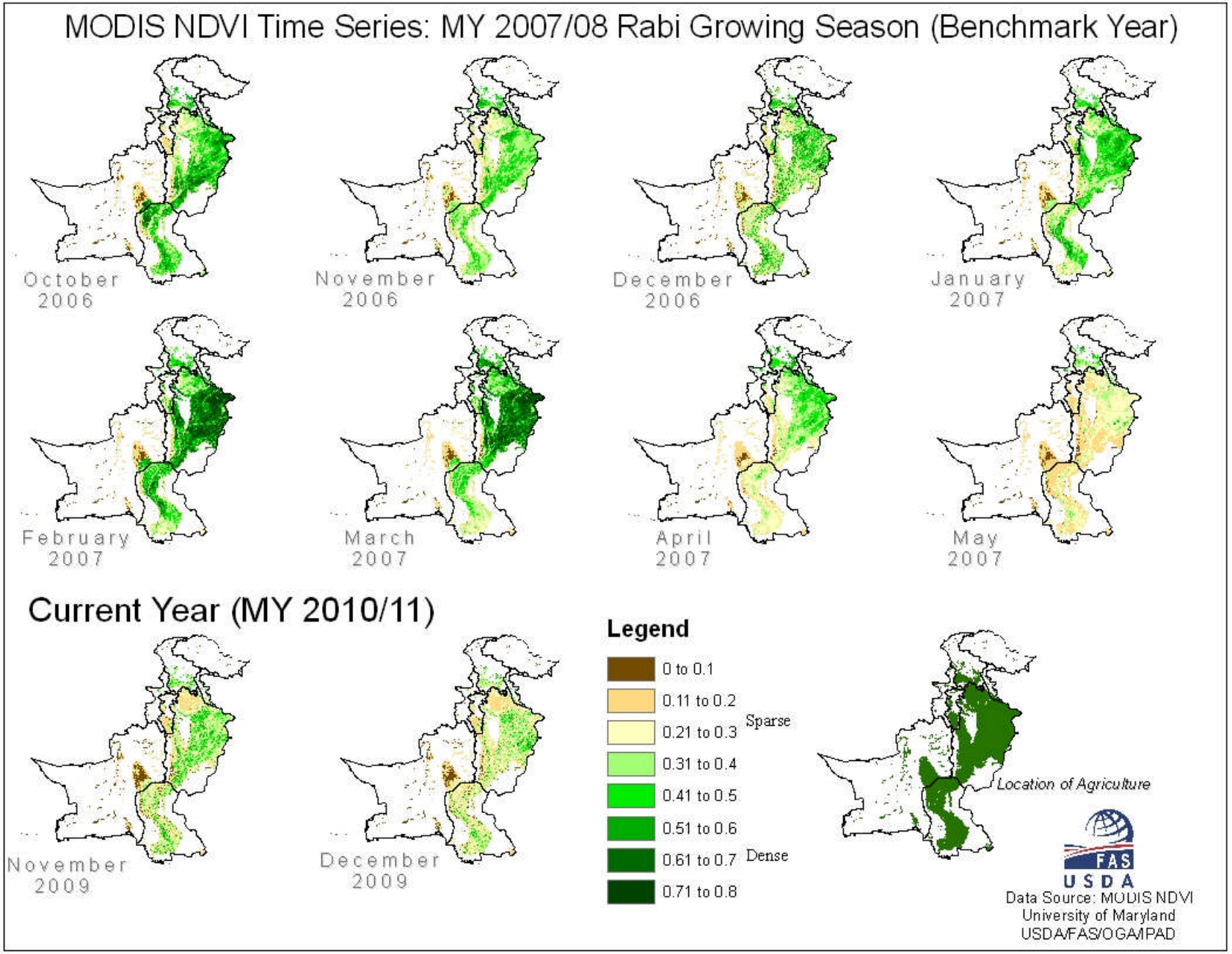

Figure 3. Vegetation growth through the winter wheat growing season.

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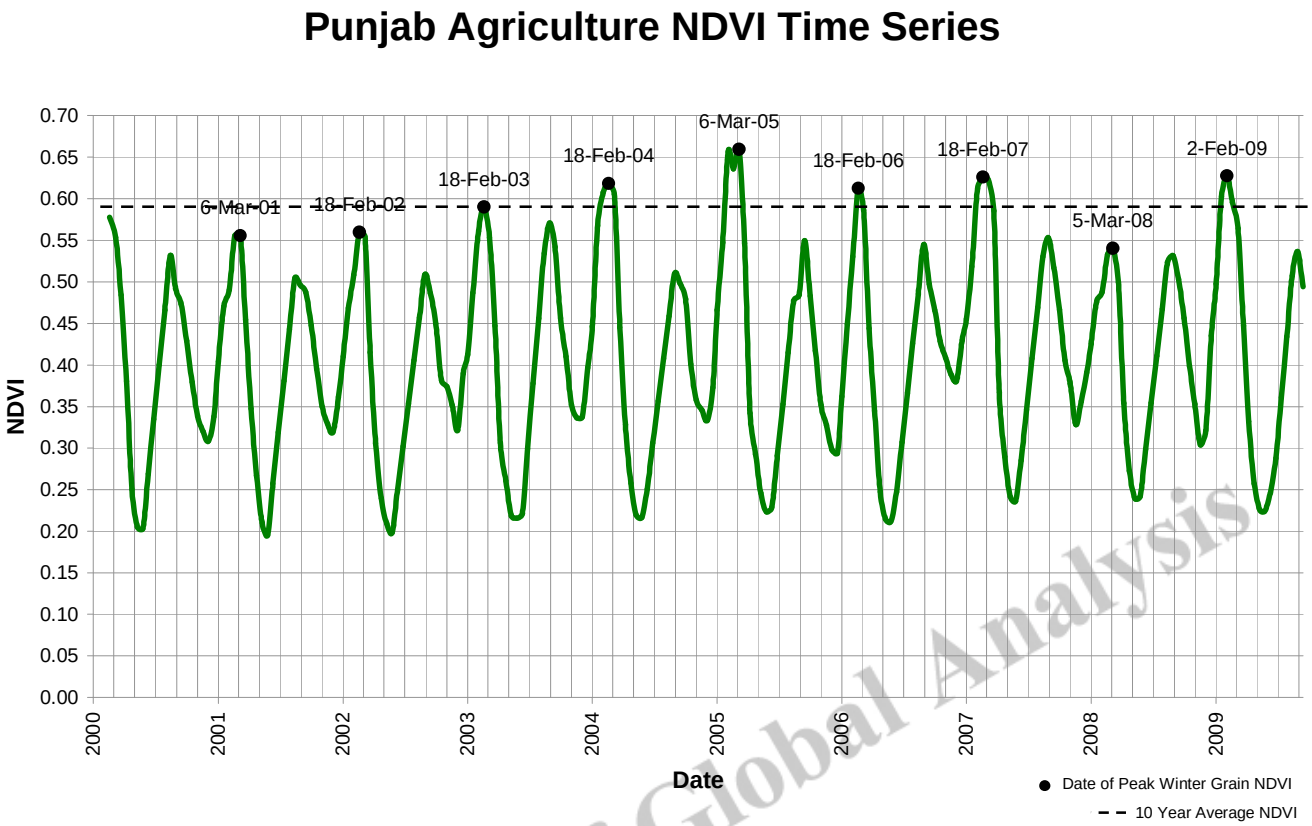

Figure 4. NDVI time series over Punjab Province, Pakistan. Punjab produces almost 76% of all wheat.

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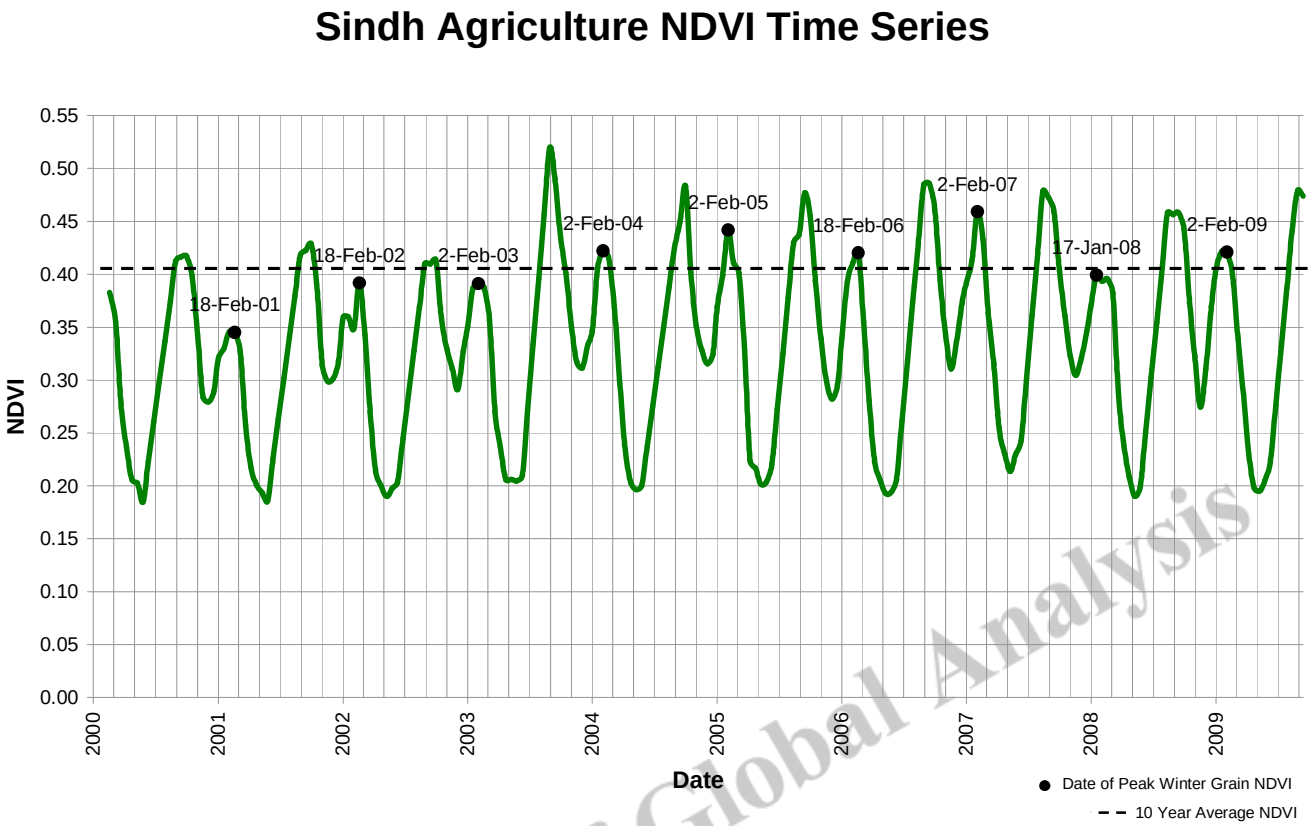

Figure 5. NDVI time series over agricultural areas of Sindh Province, Pakistan. Sindh produces over 14% of all wheat.

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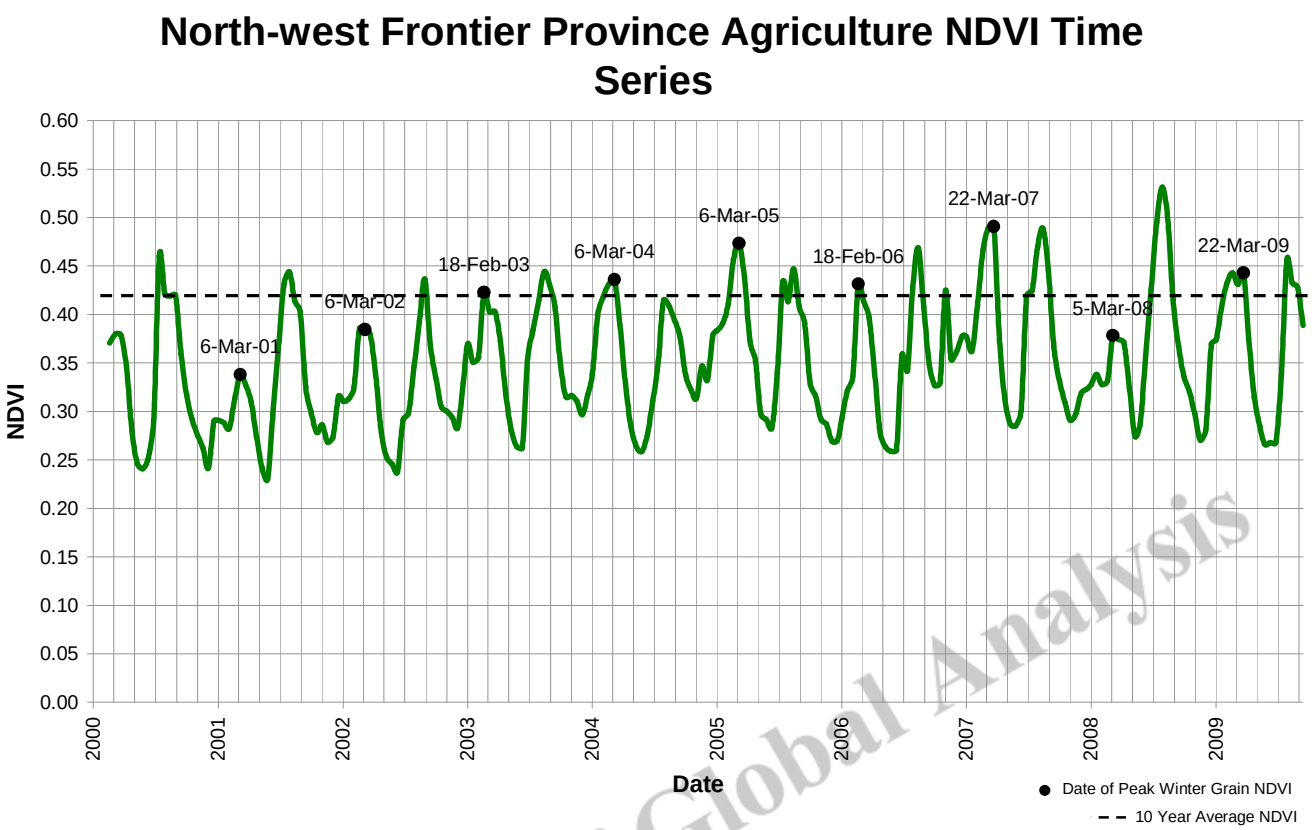

Figure 6. NDVI time series over agricultural areas of Northwest Frontier Province, Pakistan. NWFP produces 6% of all wheat.

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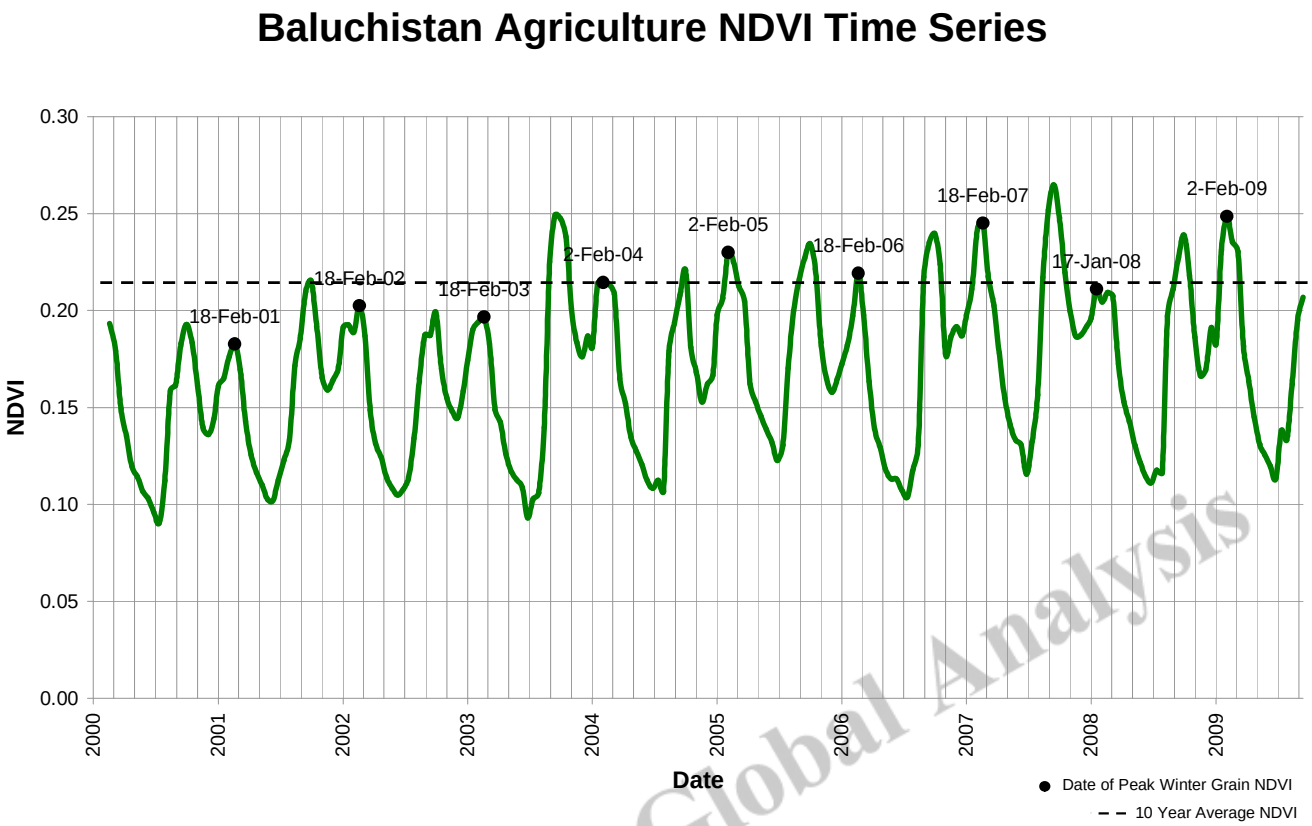

Figure 7. NDVI time series over agricultural areas of Baluchistan Province, Pakistan. Baluchistan produces 4% of all wheat.

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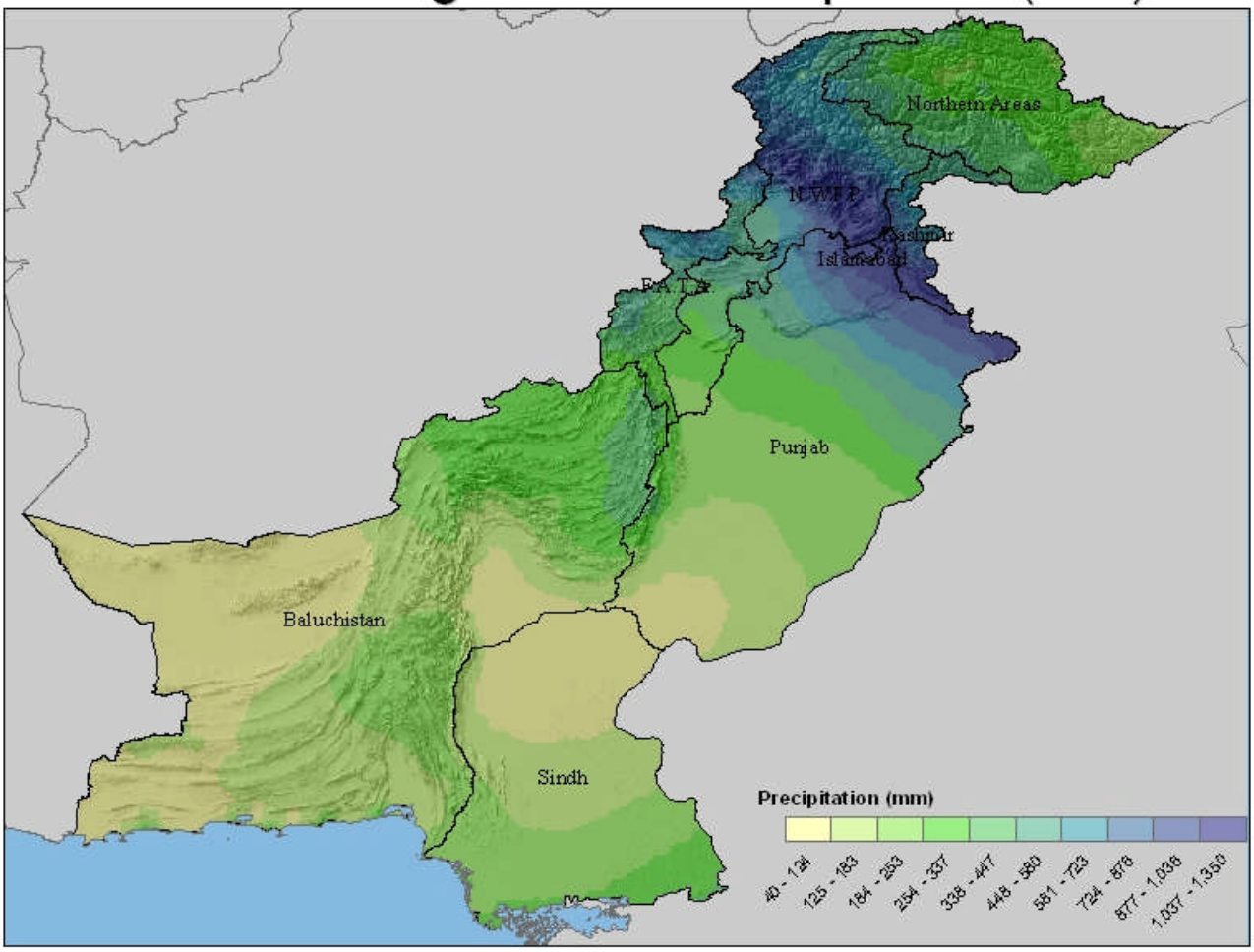
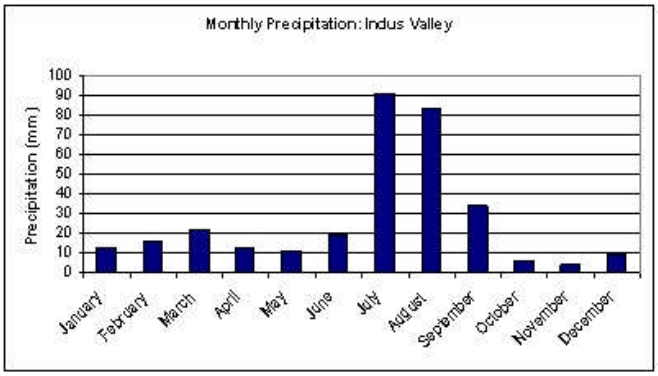
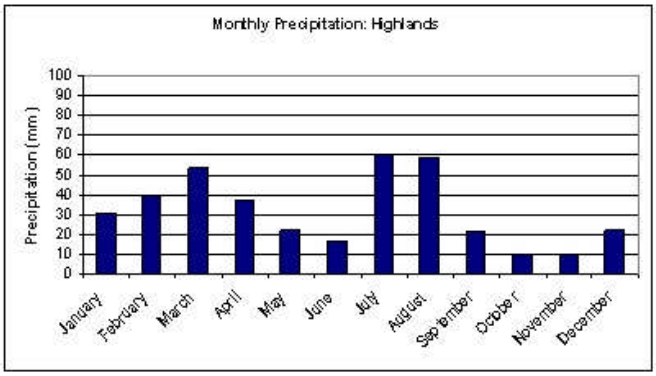
Pakistan Average Annual Precipitation (mm)







Data Source: AFWA Precipitation
USDA-FAS,
Office of Global Analysis- IPAD
Crop Explorer

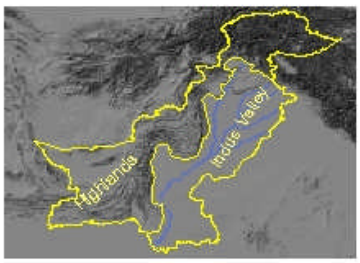


Figure 8. Average annual cumulative precipitation and bar graph of average national precipitation by month.

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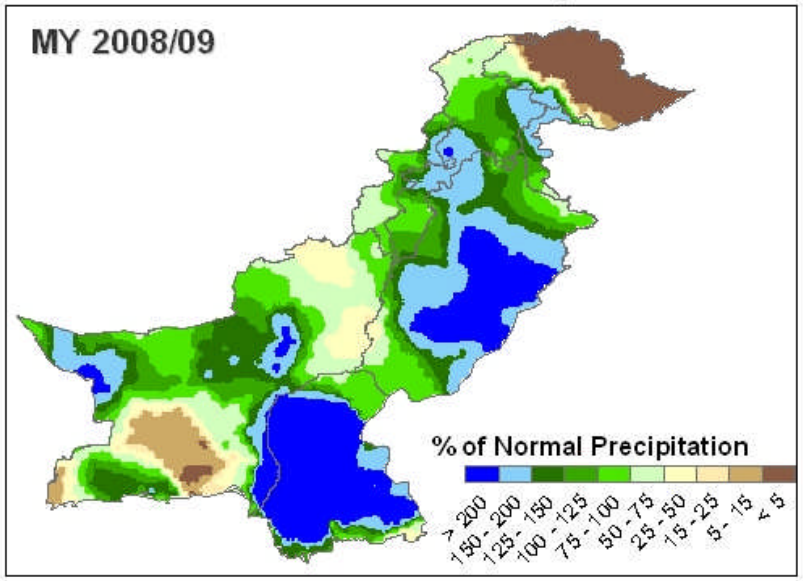
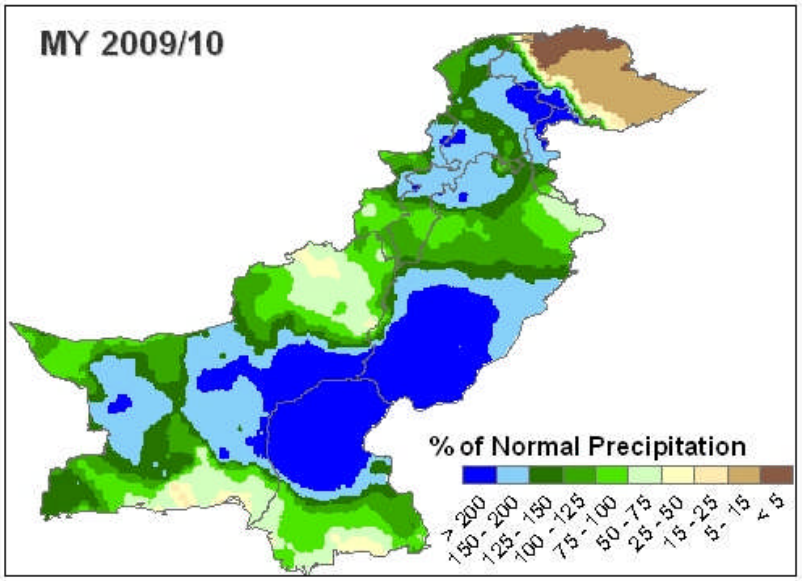
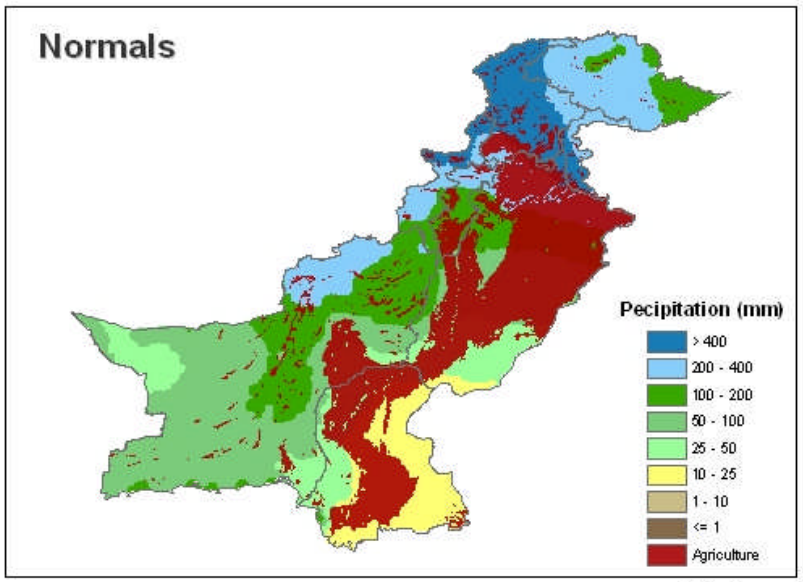
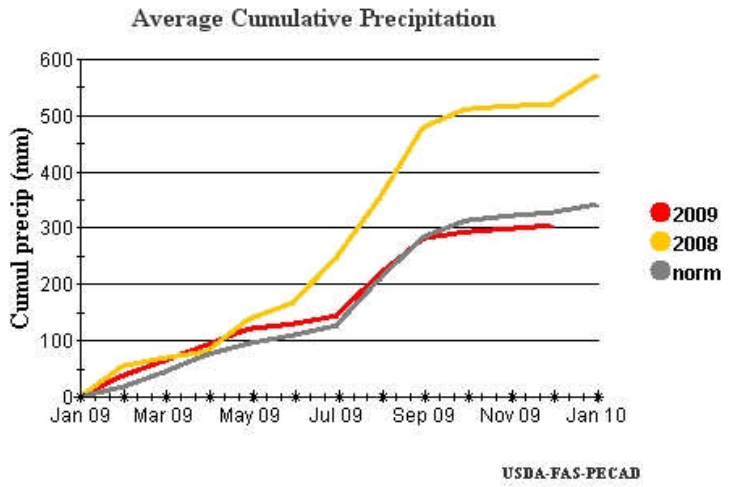
Percent of Normal Precipitation: Previous Two Winter Grains Seasons









Data Source: USDA/FAS
Office of Global Analysis

FAS
USDA

Figure 9. Cumulative percent of normal rainfall during prior two wheat seasons highlighting the 2008 and 2009 years.

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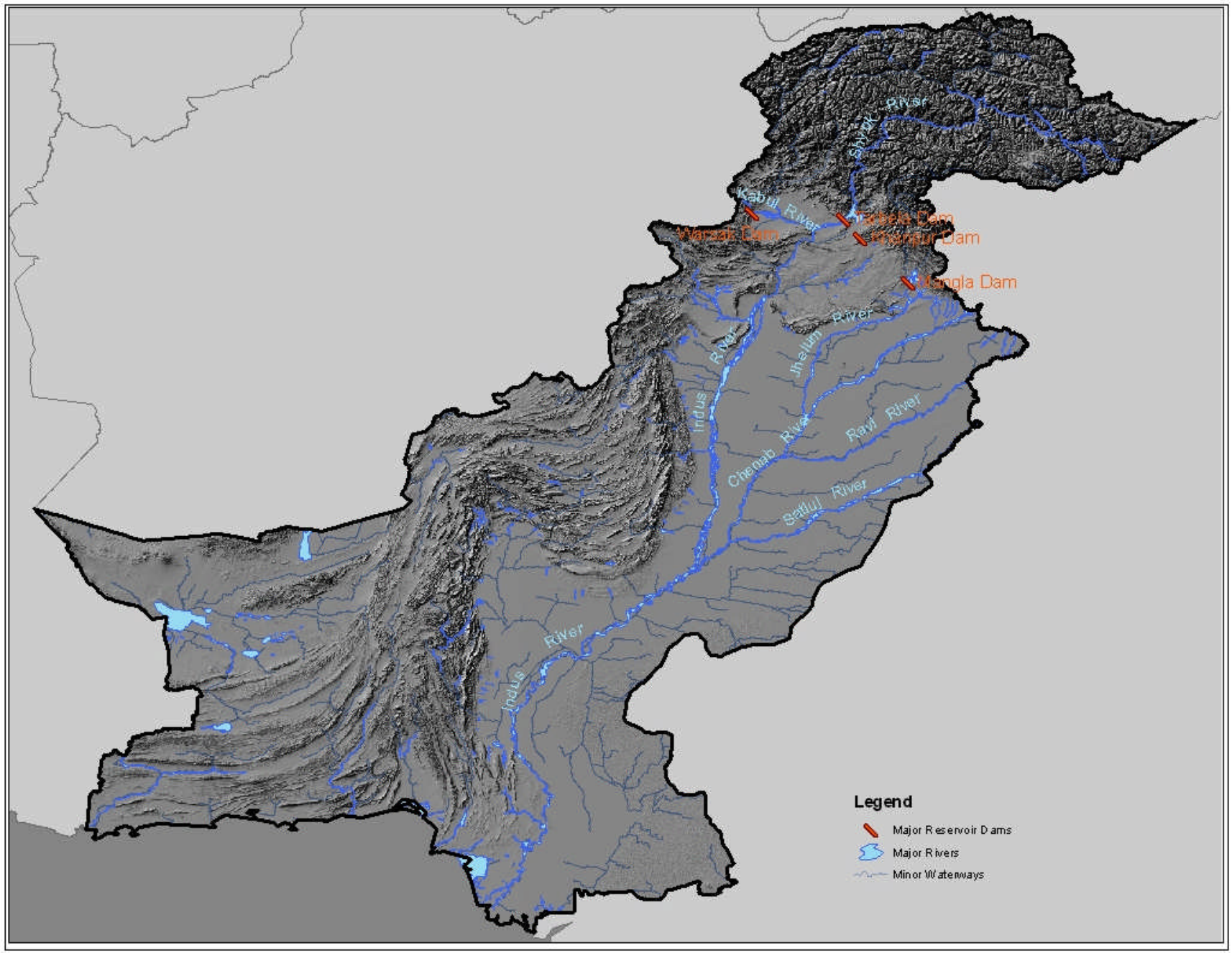

Figure 10. Major rivers and dams in Pakistan, the majority of agriculture occurs on irrigated fields within the Indus River Valley.

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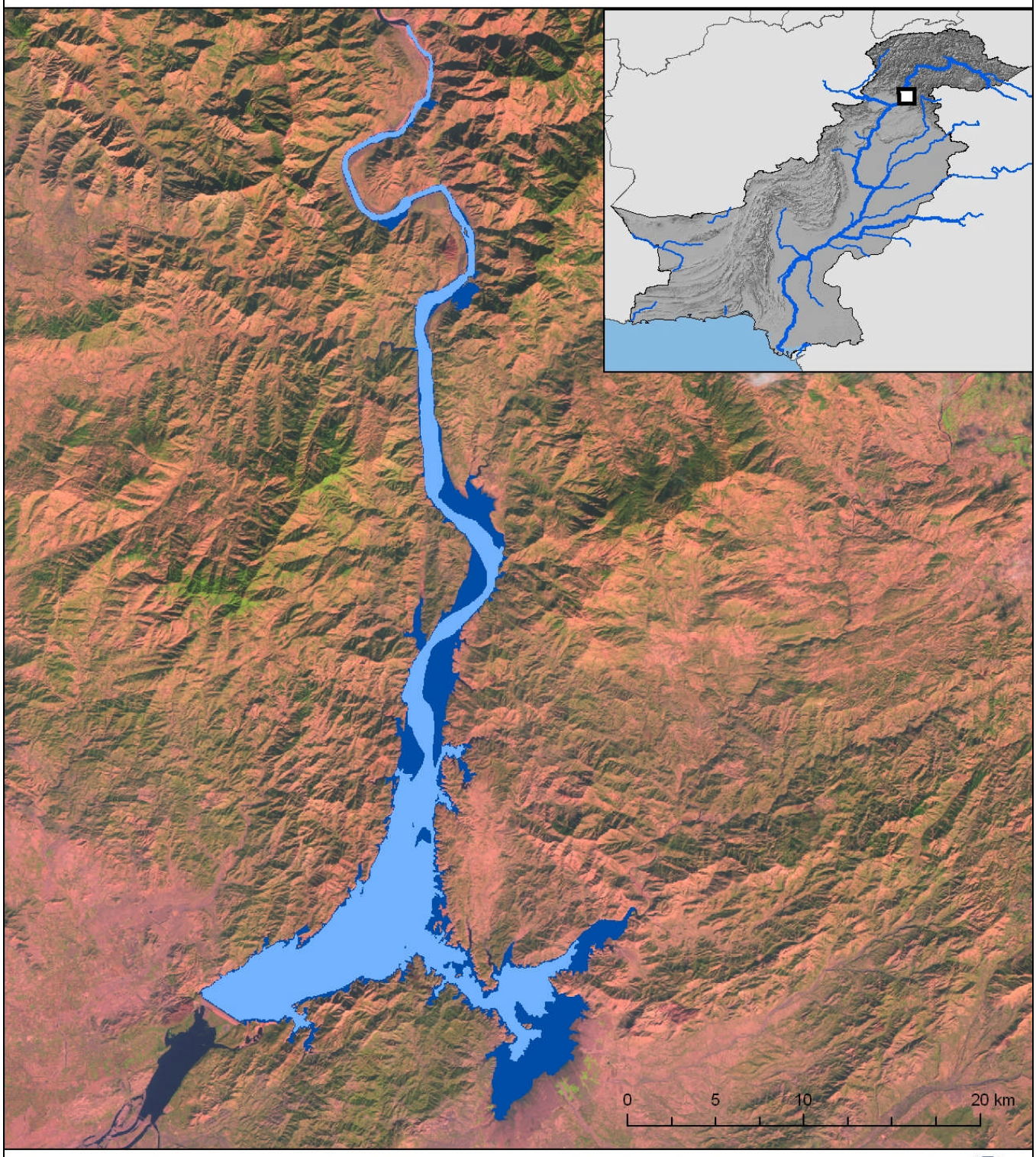
Terbela Reservoir Dynamics, 2009



Reservoir Level

05/30/2009 Area = 120.5 sq.km

11/06/2009 Area = 187.1 sq.km

Data Source:
USDA-FAS
Office of Global Analysis
International Production Assessment Division

FAS
USDA

Figure 11. Terbela Reservoir Dynamics, May – November, 2009. *Data Source: Landsat*

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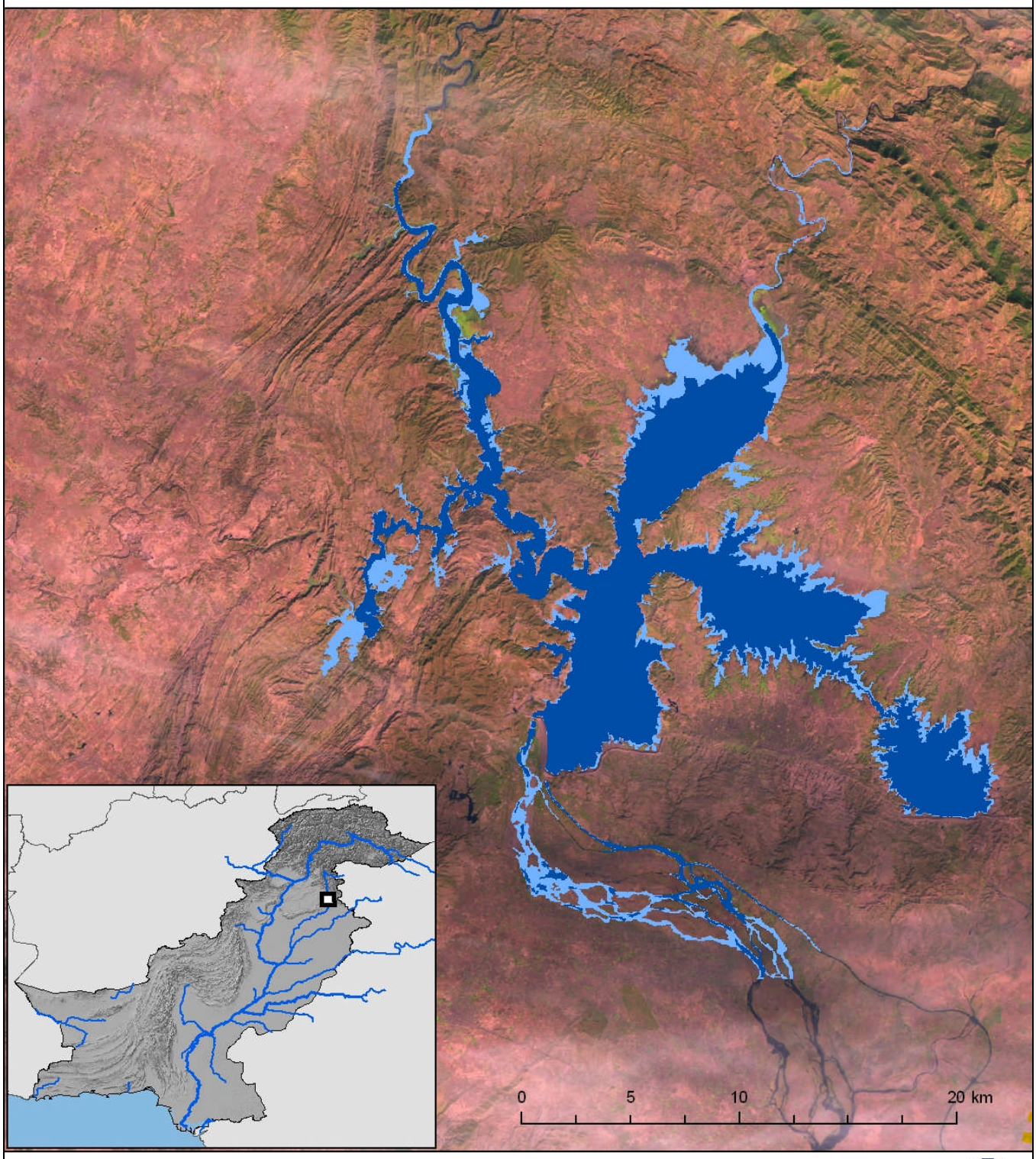
Mangla Reservoir Dynamics, 2009



Reservoir Level

05/30/2009 Area = 196.2 sq.km

11/22/2009 Area = 144.8 sq.km

Data Source:
USDA-FAS
Office of Global Analysis
International Production Assessment Division

FAS USDA

Figure 12. Mangla Reservoir Dynamics, May – November, 2009. *Data Source: Landsat*

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Commodity	Attribute	Country	2000/2001	2001/2002	2002/2003	2003/2004	2004/2005	2005/2006	2006/2007	2007/2008	2008/2009	2009/2010
Wheat	Area (1000 HA)	Pakistan	8,463	8,181	8,058	8,034	8,216	8,358	8,355	8,400	8,200	9,000
	Yield (MT/HA)	Pakistan	2.49	2.33	2.26	2.39	2.37	2.59	2.55	2.77	2.62	2.67
	Production (1000 MT)	Pakistan	21,079	19,024	18,227	19,183	19,500	21,612	21,277	23,300	21,500	24,000

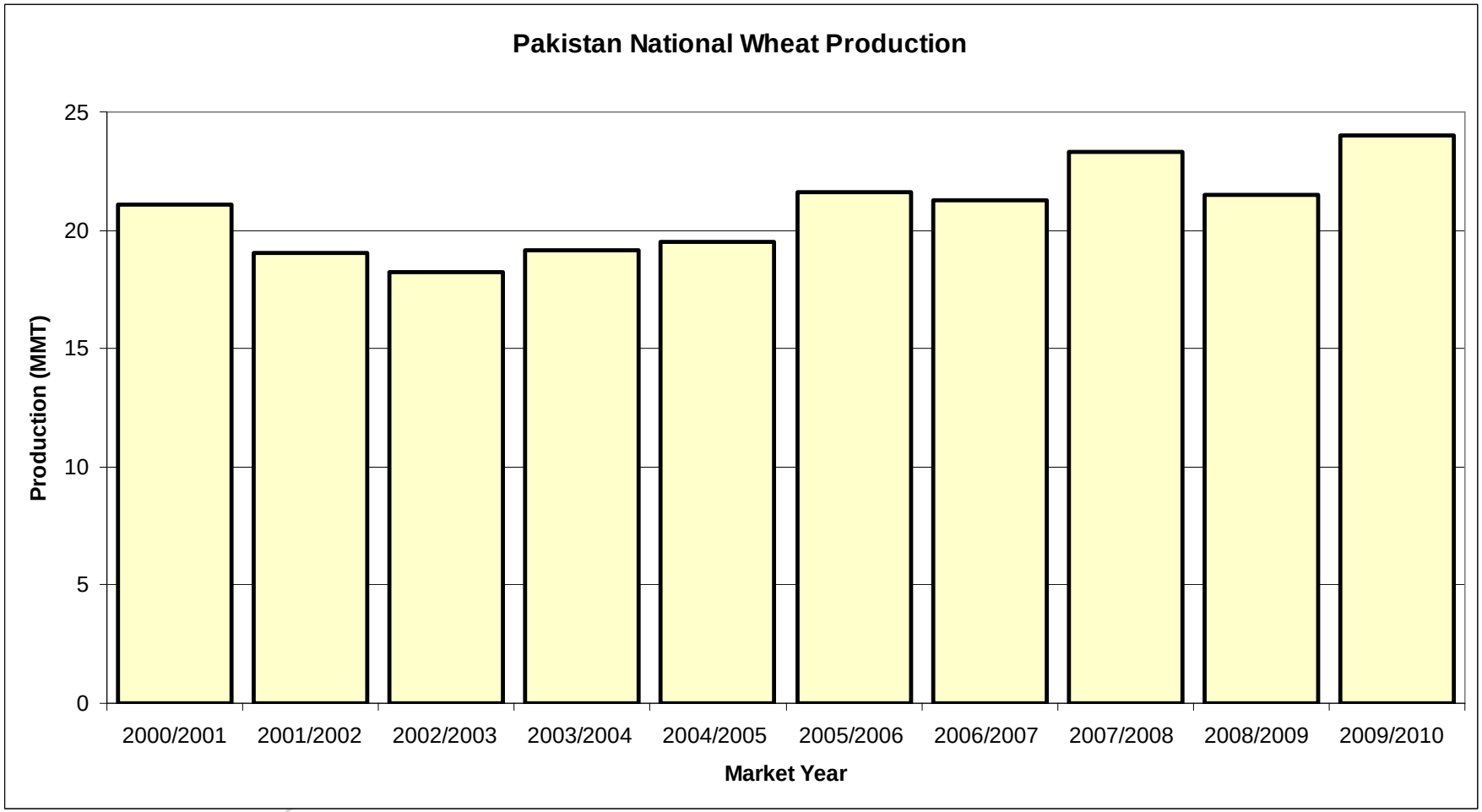

Figure 13. National wheat production statistics previous 10 crop seasons.

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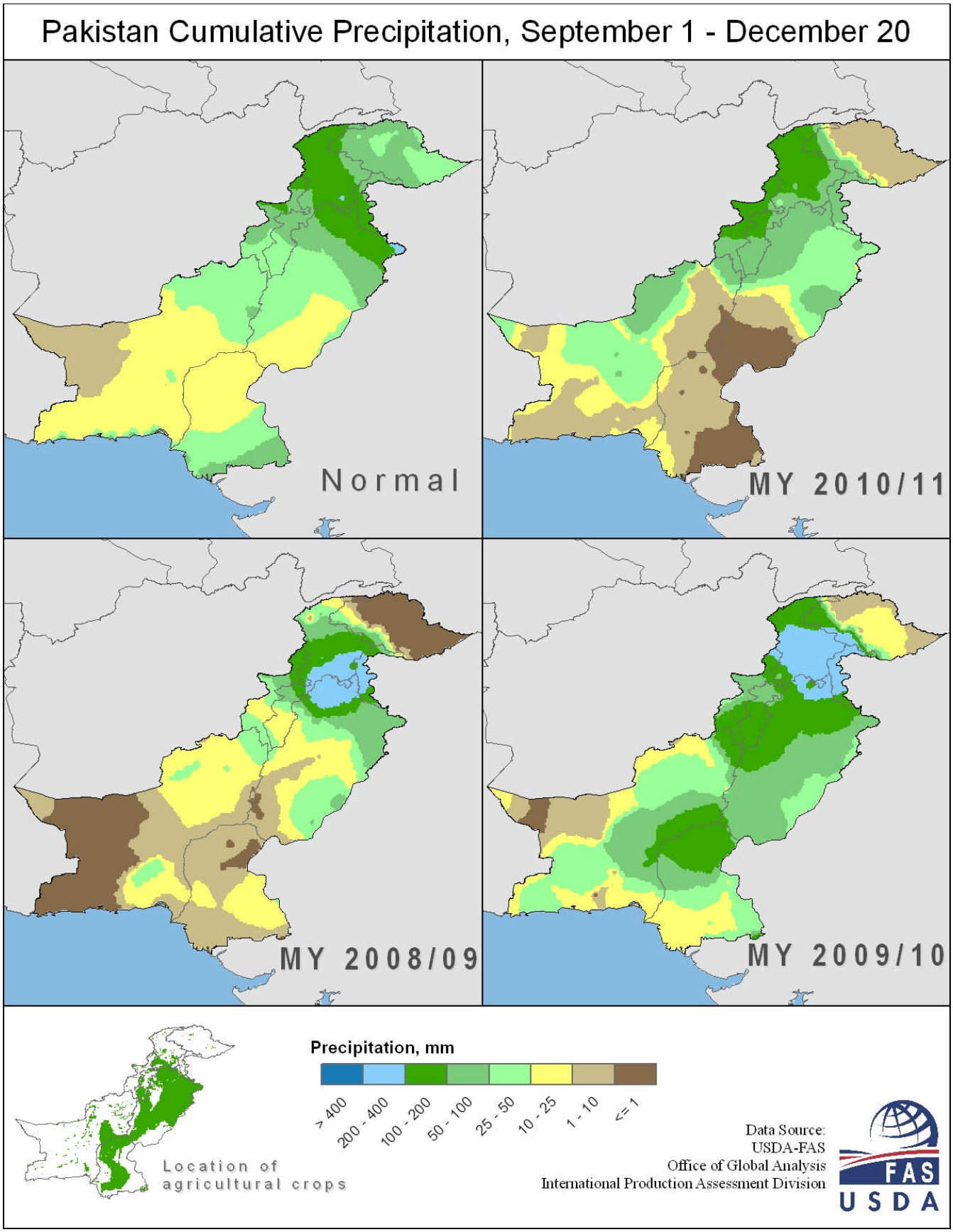

Figure 14. Season to date cumulative precipitation September 1 to December 20, current year compared against previous two crop seasons. *Data Source: Crop Explorer*

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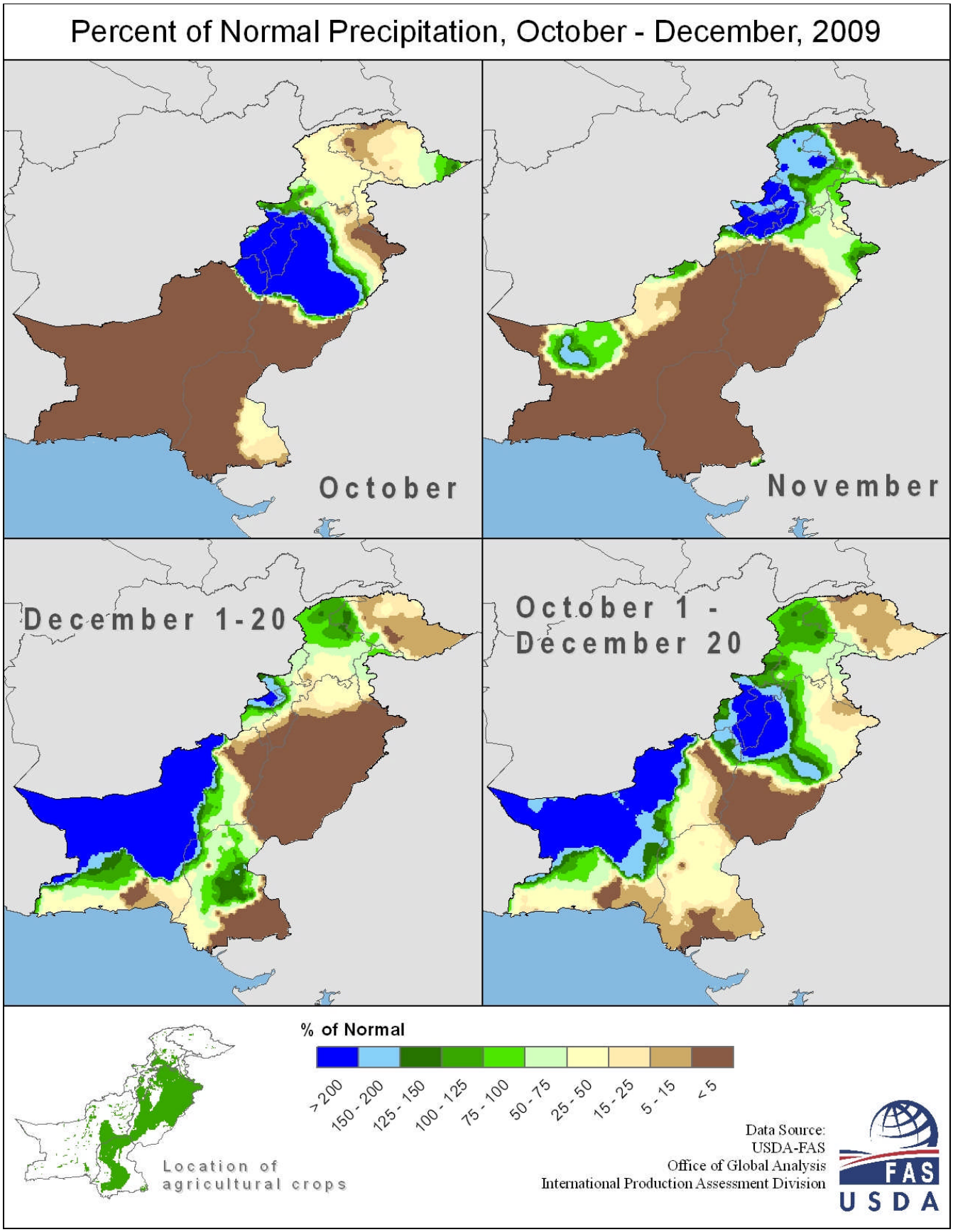

Figure 15. Percent of normal precipitation month to date and season to date over Pakistan. *Data Source: Crop Explorer*

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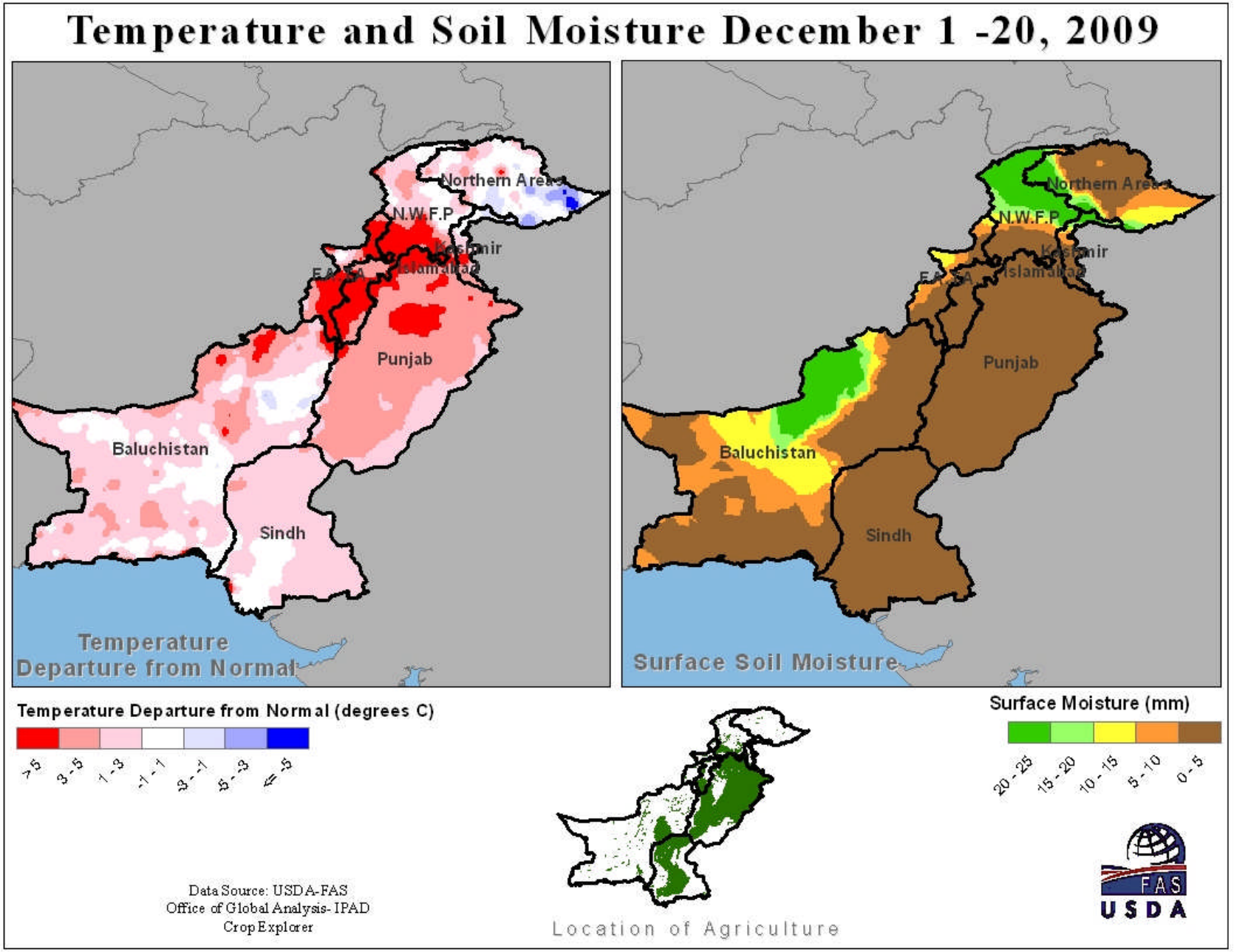

Figure 16. Pakistan temperature departures from normal for the first two decades of November, 2009 (MY 2010/11) and surface soil moisture, a function of evapotranspiration and precipitation. 10-mm or less surface moisture will not support seed germination or early growth potentials for a recently emerged crop.

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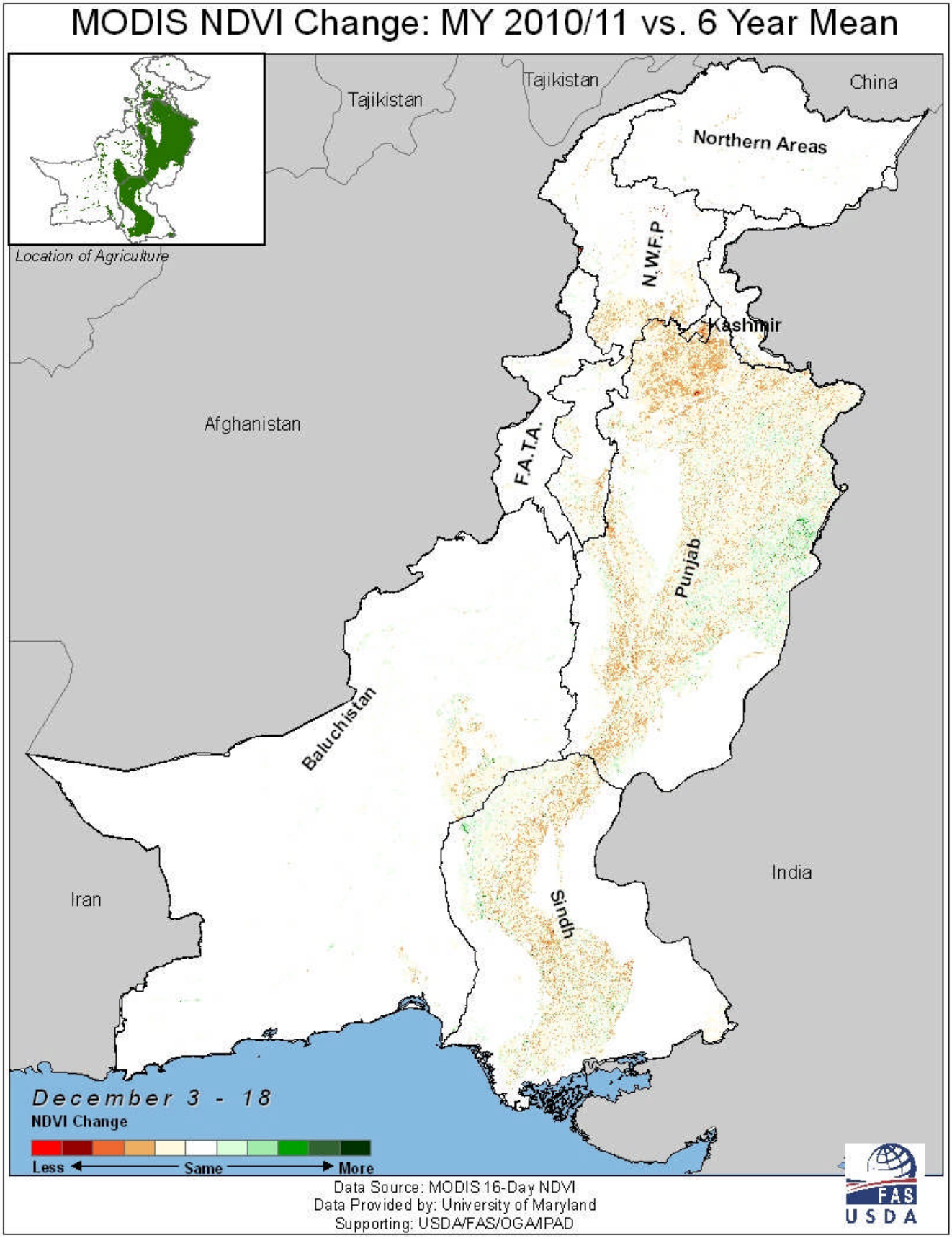

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Figure 17. NDVI Comparison, current status of agricultural field green vegetation (MY 2010/11) compared against previous six year average.

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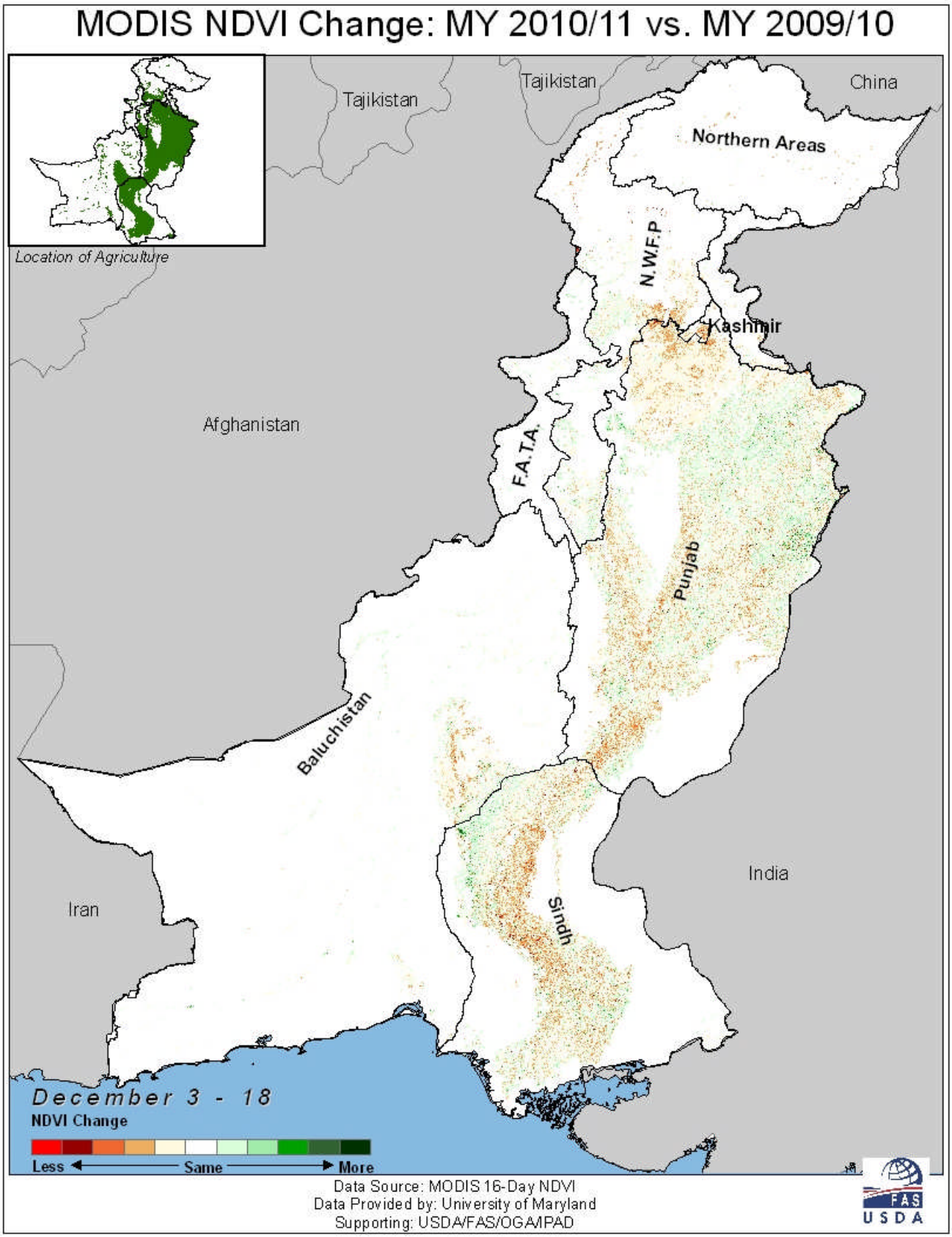

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Figure 18. NDVI Comparison, current status of agricultural field green vegetation (MY 2010/11) compared against previous year (MY 2009/10).

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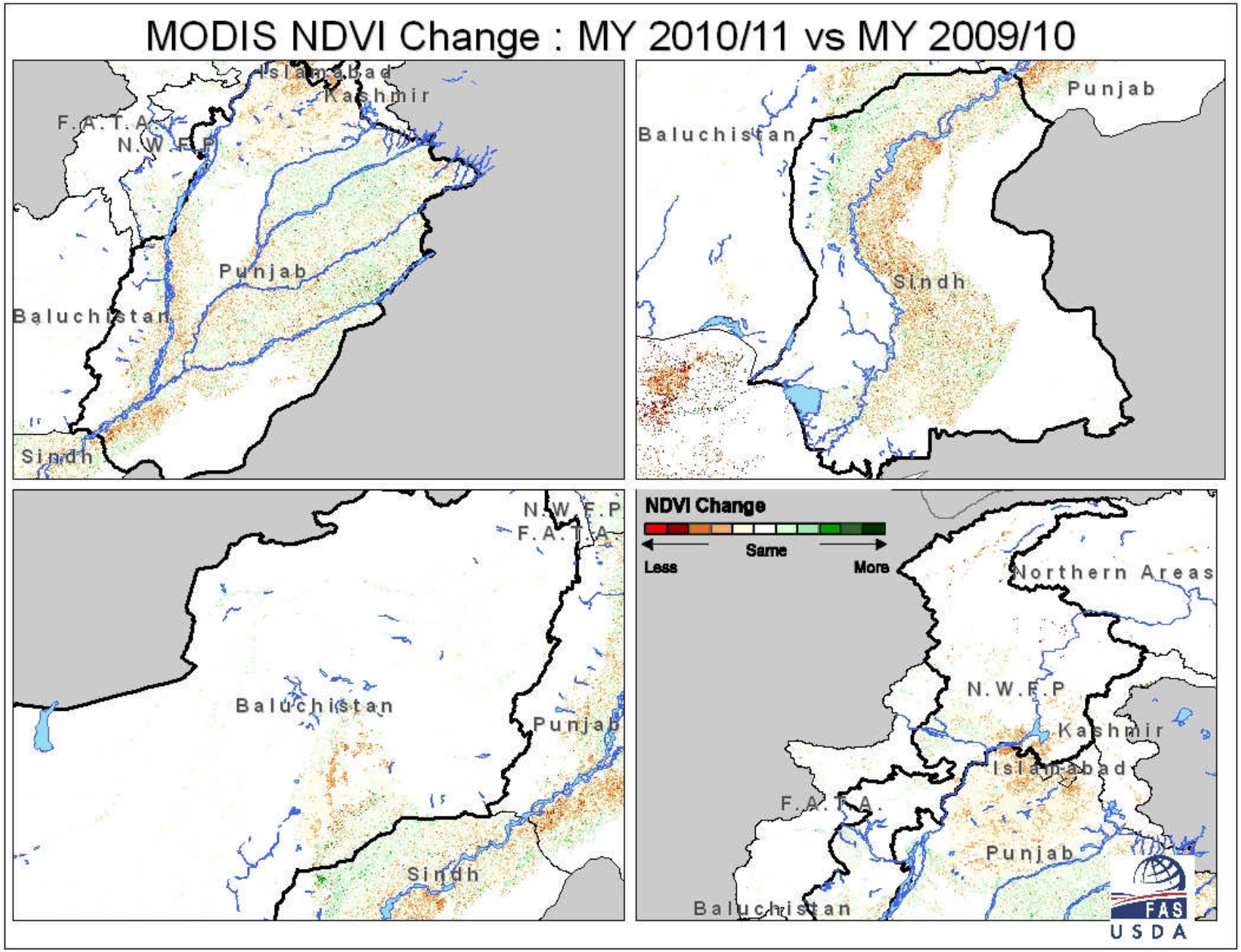

Figure 19. NDVI Comparison, current status of agricultural field green vegetation (MY 2010/11) compared against previous year (MY 2009/10).

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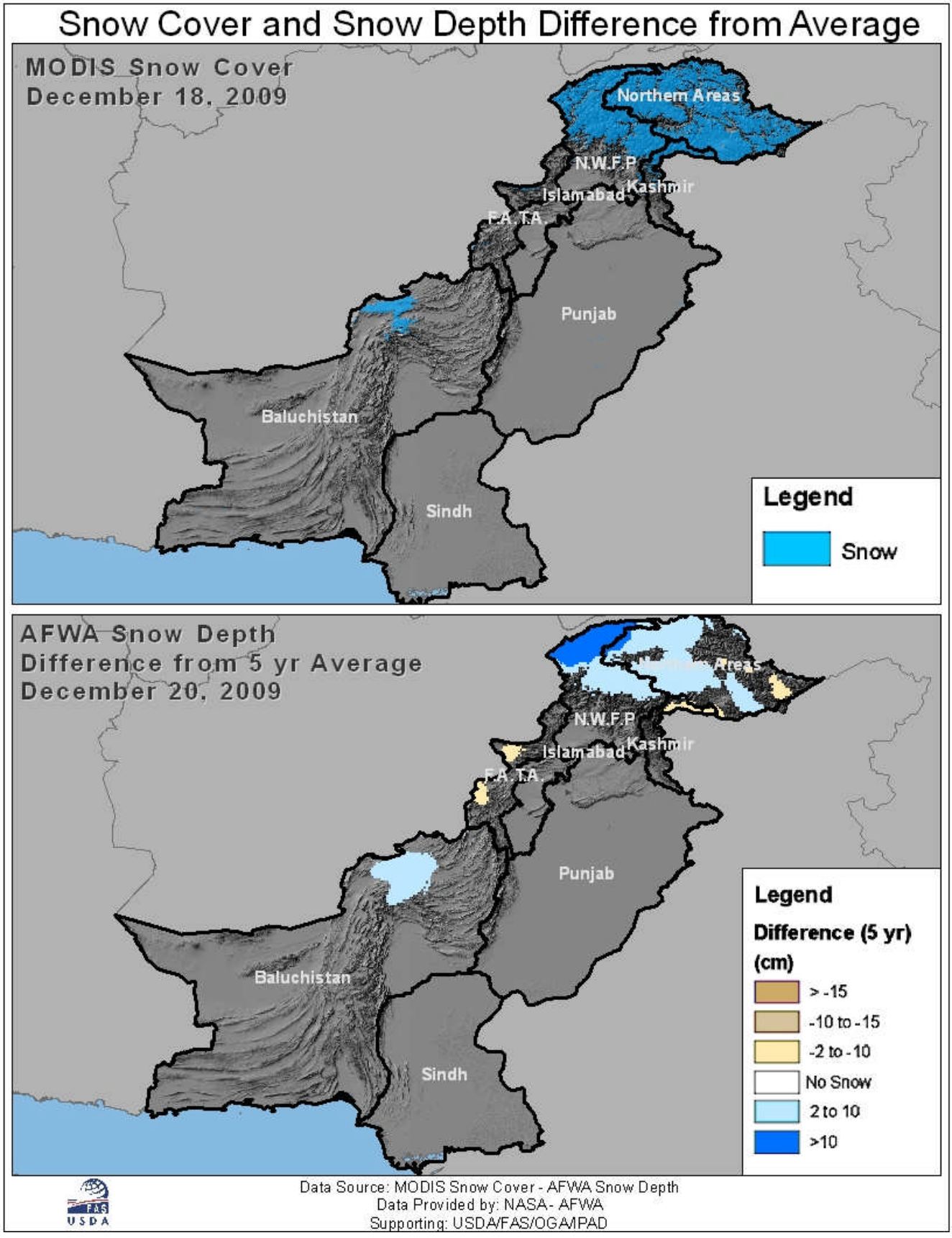

Figure 20. Location of current snow cover and snow depth difference from average. *Note: the disparity in area and location between the snow cover and snow depth products is a function of sensor resolution from which the data is derived.*

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