



2020

Plowprint



World Wildlife Fund's 2020 Plowprint Report finds that from 2014 to 2018, tillage of grasslands across the Great Plains occurred at an average rate of four football fields every minute. This year's report is based on an updated, more accurate methodology, which reveals that although the number of tilled acres of intact grasslands has declined, the rate of conversion is still too high to sustain the wildlife and people that are dependent on intact grasslands. For the first time, this year's report also includes a separate analysis of the Mexican portion of the Great Plains, which will give readers a more complete overview of the state of the grasslands across the entirety of the region.

Private landowners and Native nations remain the biggest defense against grasslands loss. The vast majority (~90%) of the remaining intact grasslands across the Great Plains are not protected in national parks, but are under the management of the individuals and communities who inhabit this vast region. In recent years a rise in extreme weather events, challenging trade

POSITIVE TREND:

There was a significant increase in perennial habitat; up 440,000 acres in the NGP and 2 million acres across the Great Plains.

AREA OF CONCERN:

The rate of grasslands loss in the Northern Great Plains (NGP) was ~550,000 acres, with 2.1 million acres converted across the entire Great Plains.

policies, and a global pandemic has added additional pressures to maintaining agricultural livelihoods. The novel coronavirus has negatively impacted food supply chains and the delivery and accessibility of nutritious food and clean water. Now, more than ever, policies and programs are needed that incentivize grassland stewardship and address the needs of rural and indigenous communities.

Improved Analysis

To more effectively track grasslands loss, WWF has updated the methodology from that used in the first three Plowprint Reports (2016-2018) to incorporate changes to the underlying data and reduce possible error in estimates. These changes include:

1. The USDA Cropland Data Layer (CDL) was improved to a spatial resolution of 30m instead of 56m. All prior years of the Plowprint were re-analyzed to incorporate the improved spatial resolution.
2. Open water and developed areas in the U.S. were updated based on newly released National Land Cover Database (NLCD) data current through 2016.
3. WWF created a "roads mask" based on TIGER 2019 and Canada Road Network 2018 data. Line features for primary, secondary, and local roads were buffered to 30m to remove an error associated with road edges. The new water, developed, and roads masks were applied to all years of the Plowprint spatial data for consistency.
4. A 2-year crop rule was implemented for cropland to enter the Plowprint. A pixel must now be identified by the CDL or Canadian Annual Crop Inventory (ACI) as cropland for two sequential years in order to be counted as Plowprint. This check was established to improve error rates by excluding "one-off" misidentifications. This means that there will now be a year-long lag in the appearance of newly converted cropland as reported in the Plowprint Report. For example, land that was first converted in 2018 now has to be identified as crop in both the 2018 and 2019 CDL/ACI datasets before it is included as part of the Plowprint.
5. The CEC portion of the grasslands in northern Mexico have also been included for the first time, though because different methods were used than for the U.S. and Canadian grasslands, we report on Mexico separately (see page 4).

2020 Plowprint Report Overview

In 2018—the year of land use that the 2020 report analyzes—grasslands loss in the Northern Great Plains (NGP) was approximately 550,000 acres, with 2.1 million acres converted across the Great Plains of the U.S. and Canada. This is a slight increase in annual conversion from 2017 of ~476,000 in the NGP and 2 million acres in the Great Plains.

In a positive contrast to the amount of grassland conversion, there was a significant increase in perennial cover; up 440,000 acres in the NGP and 2 million acres across the Great Plains. Tilled land that is no longer used for row-crop production is referred to as perennial cover (e.g., USDA Conservation Reserve Program [CRP], alfalfa, hayland, restored grassland, etc.). Recently restored perennial habitat is preferable to plowed ground because it offers improved ecosystem function such as water infiltration and storage. Although it can take decades for the land to return to some semblance of the vitality it exhibited prior to being plowed up, the benefits for wildlife and ecosystem services make restoration a worthwhile pursuit¹. Many grassland birds, pollinators, and mammals are able to survive in restored perennial habitat where they could not in row-crop agriculture thanks to the improved wildlife habitat of perennial cover, which provides critical food and shelter.

The diversity of plants and soil microbiota in untilled prairie vastly outnumbers that which can generally be achieved through restoration; most grass seedings use three to seven plant species, whereas plant diversity ranges as high as 305 plant species for intact mixed-grass prairie². Once tilled, it is difficult to regain similar levels of the ecosystem services provided by intact grasslands such as belowground carbon storage. Also, grassland conversion to row crop agriculture is the greatest contributor to the loss of biodiversity among soil microbiota³ and insects⁴, which make it possible for grasslands to function efficiently. Intact prairies with a high

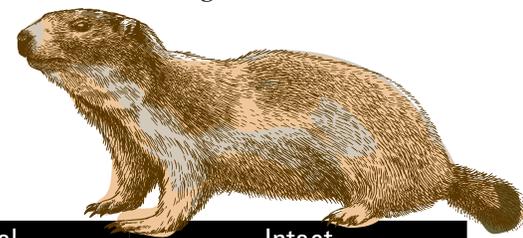
number of native species maintain nutrient cycles, soil fertility, and generally provide a higher degree of ecosystem services⁵ than tilled ground.

DID YOU KNOW?

Since 2014, tillage of grasslands within the Great Plains has continued at an average rate of four football fields every minute.

Conversion Sources

As noted in previous reports, wheat continues to be the leading annual driver of conversion within the NGP at 41% of new plantings following grassland conversion. Corn follows at 9% and soybeans come in third at 7%. The remaining crop land is composed of a wide variety of crop types. A report⁶ examining the drivers of grassland conversion in the NGP from 2012-2017 identified that wheat production associated with domestic flour mills was the greatest domestic use at 38% of converted acres. However, wheat produced on 55% of the newly tilled acres was exported. Interestingly, feed grown for cattle (47%) surpassed ethanol (33%) as the largest driver of grassland conversion to corn in the NGP. 62% of the conversion to soybean has been attributed to animal feed with 70% of that being used for cattle feed. It is important to note that most of the grassland conversion across the U.S. is for the production of corn and soy.



	Total Plowprint		Annual Expansion		Perennial		Intact	
	NGP	Great Plains*	NGP	Great Plains*	NGP	Great Plains*	NGP	Great Plains*
2018	43,022,000	239,847,000	549,100	2,147,000	4,703,000	18,955,000	131,253,000	384,079,000
2017	42,473,000	237,701,000	475,700	2,036,000	4,264,000	16,934,000	131,802,000	386,226,000
2016	41,997,000	235,665,000	552,600	2,234,000	4,150,000	17,066,000	132,278,000	388,261,000
2015	41,444,000	233,431,000	759,800	2,932,000	3,180,000	14,277,000	132,830,000	390,495,000
2014	40,685,000	230,499,000	1,139,000	4,451,000	2,811,000	13,620,000	133,590,000	393,428,000

¹Rosenzweig et al. 2016. Changes in soil properties, microbial biomass, and fluxes of C and N in soil following post-agricultural grassland restoration. *Applied Soil Ecology*. 100:186-194. ²Ode et al. 1980. The Seasonal Contribution of C¹³ and C¹⁴ Plant Species to Primary Production in a Mixed Prairie. *Ecology*, 61: 1304-1311. ³Bach et al. 2010. Soil texture affects soil microbial and structural recovery during grassland restoration. *Soil Biology & Biochemistry* 42, 2182e2191. ⁴Sánchez-Bayo & Wyckhuys, 2019. Worldwide decline of the entomofauna: A review of its drivers. *Biological Conservation*, Volume 232, Pages 8-27. ⁵Tilman et al. 1996. Productivity and sustainability influenced by biodiversity in grassland ecosystems. *Nature* 379, 718–720. ⁶Schmitt et al. 2020. Food systems supply-chain sustainability model: 2017 updates. A report to World Wildlife Fund. 30 pp. *Includes the U.S. and Canada only.

Intact Grasslands, Plowprint, and New Plowprint in 2018



Map: © WWF-US / Sarah Olimb

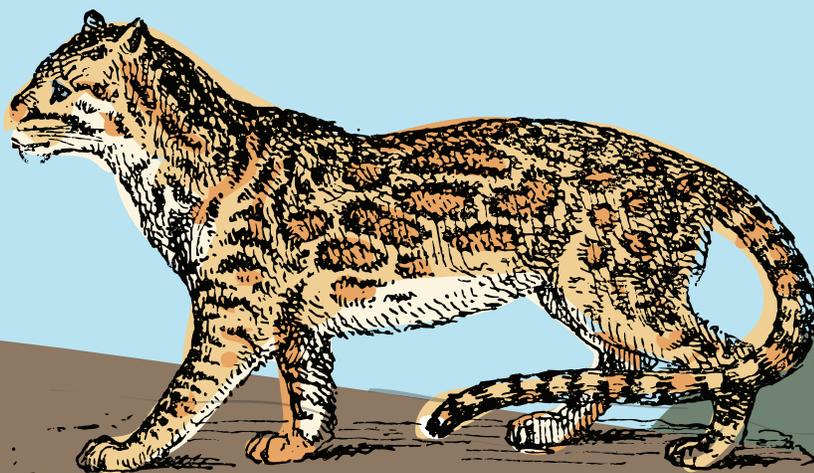
Great Plains **NGP** **Intact** **Plowprint** **New Plowprint** **Open Water** **Developed**

Map of intact grasslands, Plowprint (lands that have been planted to crops beginning in 2009) and the new addition to the Plowprint in 2018 (lands that were plowed in 2018 and verified in 2019) in the Great Plains. Because the Plowprint has a spatial resolution of 30 meters, the new Plowprint pixels are challenging to see at the scale of the Great Plains. Thus, WWF aggregated the smaller pixels to 300 meters, maintaining "new Plowprint" status if any pixel within the grouping held that designation. This allowed the pixels to be more visible at the Great Plains scale and reflect the hotspots of new conversion.

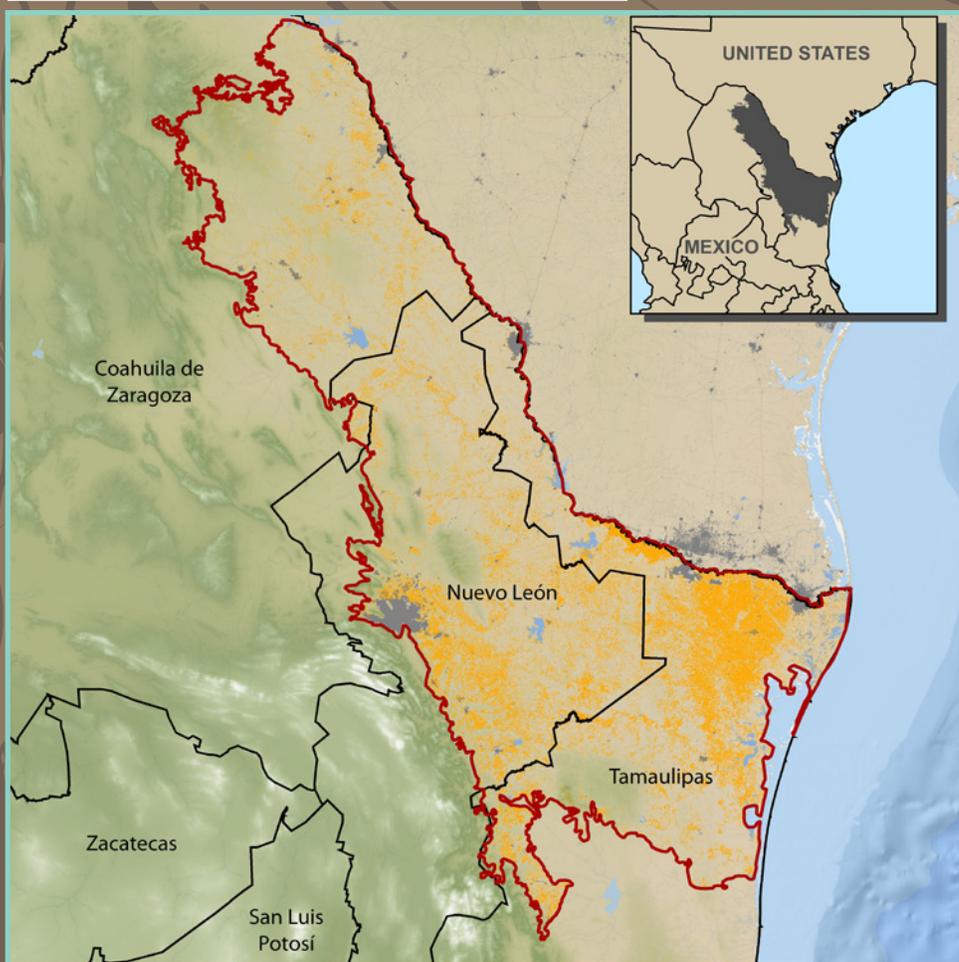
Mexican Grasslands

Beginning with this edition, the Great Plains region located within northern Mexico will be included in the Plowprint Report. We are not aware of an annual updated land cover classification for Mexico, and hope this analysis will fill a critical knowledge gap.

The table on the right illustrates a comparison of acres identified as converted between the 2018 Plowprint layer for the CEC Great Plains portion of Northern Mexico and the one-time 2017 land cover data from The National Institute of Statistics and Geography (INEGI) VI. The data indicate a high degree of overlap, estimating ~18% of the ecoregion is converted, providing support that the Plowprint method is suitable for annual updates of the region.



2018 WWF Analysis	2017 INEGI VI Land Cover
4,639,478	4,764,053



Map: © WWF-US / Sarah Olinb

Great Plains
 Plowprint
 Open Water
 Developed

NEW TO THE 2020 REPORT:

Plowprint ONLINE!

An interactive, online version of **THE U.S. AND CANADIAN** Plowprint map is now available at www.plowprint.org. Users can select and download the information for any area of interest within the U.S. or Canadian Great Plains and examine the acres of intact habitat, cumulative and new conversion to row-crop agriculture, and cropland composition.



2018 Plowprint layer developed for the Commission for Environmental Cooperation Great Plains portion of northern Mexico using supervised classification in Google Earth Engine. Satellite imagery inputs included: Sentinel-2 TOA reflectance data2, JRC Global Human Settlement Layer 20151, Hansen Global Forest Change 20154, PALSAR JAXA Forest/Non-Forest Map 2017. Sentinel data was queried for four snapshots through the growing season (May, June, July, October) and filtered for clouds; images stacked to create one multi-band image used for training and classification. Supervised Random Forest classifier used to train and estimate ag/non-ag cover across the study area at 30m scale.