Guidance on populating hay and pasture yields in NASIS

Version: July 2010

This guidance was developed from input by Larry Holzworth, Jon Siddoway, Mike Hansen, Patrick Hensleigh, and others. Mike Hansen drafted this document.

Hay and pasture yields in Montana are populated, where appropriate, at the component level only. **Map unit yields are not populated/certified in NASIS in Montana.** Of the four general forage categories listed below, only those common to the SSA will be developed and entered into NASIS. The most common hay type(s) are entered into NASIS with yields. It is acceptable to provide only the most common dryland and/or irrigated hay combination, e.g., grass, grass-legume, or straight alfalfa.

Dryland Forage

Dryland pasture and hay yields or productivities tend to sync quite closely to soil properties and climate (PPT and growing season). The resulting values array reasonably well in this context. For the process outlined here, native vegetation productivity and the results from the crop yield model are used to establish a reasonable starting point, subject to additional input and expert review.

Dryland Pasture

Step 1: Logically array the soils as to their potential for dryland pasture productivity. A reasonable approach (according to Ecological Sciences Staff as indicated in the AUM calculation for DOR) is to multiply the potential native vegetation production values by 1.5 (e.g., using the normal growing-season production value).

First calculate the native rangeland AUMs/Acre (see example above)
Multiply native rangeland AUMs/Acre by 1.5
AUM per acre = (0.25 AUM per acre) x 1.5 = 0.38 AUM per acre

Note: Pasture yields have been tempered to leave enough of the plant to remain vigorous, considering losses/efficiency of grazing. These adjustments are built into the base AUM calculations as follows:

Calculating native rangeland AUMs

Given: Annual forage production = 900 pounds per acre. One AUM = 915 pounds.
AUM per acre = (900 pounds per acre) x (25 percent grazing efficiency)
= (225 pounds available forage per acre)/(915 pounds per AUM)
= 0.25 AUMs per acre

The logic for using 1.5 times the value obtained above is due to higher grazing efficiency and higher utilization of the generally more palatable fare available in a pasture situation. Results should be rounded to the nearest tenth of an AUM.

Using this approach, forested components will be significantly underestimated because use as pasture typically removes or reduces the overstory. These forested components should be correlated to values from similar soils/climate lacking the forest canopy or adjusted accordingly.

Step 2: **Filter the list of components to those logically used for pasture** in the SSA/area. One approach would be to only consider soil components that have a base barley yield of, for instance, ≥15 bushels. For example, barley is commonly used as forage, and this yield level would provide significant forage. To this resulting list of components, you need to add soils excluded from the yield model because of wetness. These wetter soils are, in many cases, the highest yielding and most appropriate dryland pasture soils.

Step 3: Once you have the list pared and arrayed, **review for reasonableness and calibrate** the AUMs assigned in the context of feedback from the District Conservationists, County Agents and others that have local insight into pasture productivity in the area. Production values can easily be factored up or down a bit, based on expert input to your model, using calculated columns in a spreadsheet, for example.

<u>Dryland Hay</u>

In contrast to dryland pasture, dryland hay total fiber produced/captured will be a bit higher, reflecting a much higher efficiency of harvest, while still leaving enough of the plant for recovery/regrowth following the harvesting activity.

Dryland hay is a land-use category detailed in the DOR FLU (statewide high-resolution land use) layer. It would be a good idea to look at these designations in the subject SSA to verify their usefulness. If they look relatively accurate, the FLU layer could be used to extract soil map units actually being used as nonirrigated hay. This FLU layer is available from the State Soils Staff or the State GIS specialist, if it is not found on your local system.

Values are presented in terms of tons/acre. Assumption is that dryland hay producers get one cutting per growing season.

Step 1: Model a starting point for **dryland hay derived from the native production value** (e.g., normal year) using the following formula: # native production X 1.2 (factored up using preferred adapted species) X 0.7 (harvest efficiency)/2000 = estimated tons of production.

Examples:

#600 X 1.2 X 0.7/2000 = 0.25 tons/acre/year for dryland hay (shallow site, 12.5 inches of PPT)

#1200 X 1.2 X 0.7/2000 = 0.504 tons/acre/year for dryland hay (loamy site, 12.5 inches of PPT)

#2500 X 1.2 X 0.7/2000 = 1.05 tons/acre/year (subirrigated site, LRU Y)

#3500 X 1.2 X 0.7/2000 = 1.47 tons /acre/year (wetland site, LRU Y, likely native hay)

Entries into NASIS should be rounded to the nearest tenth of a ton. These numbers could be bumped up a fraction for legume mix.

Step 2: **Filter the list of components to those logically used for dryland hay** in the SSA (see FLU layer mentioned a few paragraphs above). Another approach would be to include soil components that have a modeled barley yield of, for instance, ≥15 bushels. Filtering would establish a lower threshold of soil component inclusion. For example, barley is commonly used as forage, and this yield level would provide significant forage. To this resulting list of components, add soils excluded from the yield model because of wetness. These wetter soils are, in most cases, the highest yielding and most appropriate dryland hay soils.

Step 3: Once you have the list pared and arrayed, **review for reasonableness and calibrate** the tons/acres assigned in the context of feedback from the District Conservationists, County Agents, and others who have local insight into dryland hay productivity in the area. Production values can easily be factored up or down a bit, based on expert input to your model, using calculated columns in a spreadsheet, for example.

Irrigated Forage

Unlike dryland forage yields, as outlined above, irrigated yields are much **less** sensitive to inherent soil properties and precipitation. Irrigation management and water availability are much more significant variables. Good irrigation management and adequate water availability are assumed in the irrigated yield estimates provided in NASIS.

Irrigated Pasture

Step 1: As many suitable soils are not irrigated, largely because of water availability, **establish a reasonable list of soil map units actually being irrigated for pasture**. This category can be a bit squishy compared to irrigated hay, mostly in the process of refining a list of map units that are used for irrigated pasture.

Many areas of irrigated hay are used for aftermath grazing, meaning that grazing occurs at some level following haying activities. This NASIS yield estimate does not attempt to capture or account for aftermath grazing.

A readily accessible source of georeferenced irrigated acres is the FLU layer referenced above in the dryland hay section. Intersecting the soil survey polygons using the polygons coded "I," and summarizing, will result in acres of soil map units under some irrigation system. The irrigation types detailed in the FLU data are flood, sprinkler (nonpivot), and pivot sprinklers. There is the problem of isolating irrigated pastures from irrigated hayland and other crops. Experience shows that most pastures use systems other than pivots. This information may be used to help isolate or narrow the list of irrigated pasture map units. It is suggested that map units with very small acres in irrigated pasture not be provided with AUM production entries in NASIS.

In surveys with irrigated valleys where sugar beets and corn dominate as the irrigated crops, the areas that are dominantly irrigated pasture should be isolated for evaluation, excluding the beet/corn areas and, to the extent possible, the irrigated haylands.

Step 2: Once you have the list of irrigated pasture map units and related soil components, you are ready to **array them**. A suggested method to rank/array the soil component list is to employ dryland barley yields. Sorting the resulting list of irrigated soil components by modeled dryland barley yields will provide a reasonable array by inherent productivity. Climatic factors are already considered.

Step 3: Once the array is established, the challenge is to **establish a reasonable range in expected production** (AUMs/acre/year). You should obtain an estimated low and high total irrigated pasture production in AUMs relevant to the SSA/area in question. Pasture is assumed to be primarily adapted grass species (cool season, warm season, or a mix).

> Example: The range in production for irrigated pasture is 1.0 to 2.5 AUMs/acre/year. A method to array the identified soil components is to sort them by modeled barley yield, assigning the lowest 1.0 AUM and the highest 2.5 AUM and prorate those in between. Results should be rounded to the nearest tenth of an AUM for NASIS entry.

As detailed in the forage types mentioned above, there are many exceptions to any set of rules, but this process should give you a foundation upon which to make adjustments and refinements.

Step 4: Once you have the list arrayed and modeled, obtain objective **review for reasonableness and calibrate** the AUMs/acre assigned in the context of feedback from the District Conservationists, County Agents, and others who have local insight into irrigated pasture productivity in the area. Production values can easily be factored up or down a bit, based on expert input to your model, using calculated columns to uniformly or selectively modify in a spreadsheet, for example.

Irrigated Hay

Step 1: As many suitable soils are not irrigated, largely because of water availability, **establish a reasonable list of soil map units actually being irrigated**. The acres under irrigation in an area are typically quite stable. A readily accessible source of georeferenced irrigated acres is the FLU layer referenced above in the dryland hay section. Intersecting the soil survey polygons using the polygons coded “I,” and summarizing, will result in acres of soil map units under some irrigation system. The types detailed are flood, sprinkler (nonpivot), and pivot sprinklers. It is suggested that map units that show up on the list with minor acres do not need to be provided with irrigated hay yields. In surveys with irrigated valleys where sugar beets and corn dominate as the irrigated crops, the areas that are dominantly irrigated hay can be isolated for evaluation, excluding the beet/corn areas.

Step 2: Once you have the list of irrigated hay map units and related soil components, you are ready to **array them**. A suggested method to rank/array the soil component, irrigated hay production, is again to employ dryland barley yields. Sorting the resulting list of irrigated soil components by modeled dryland barley yields will provide a reasonable array by inherent productivity. Climatic factors are already considered.

Step 3: Once the array is established, the challenge is to **establish a reasonable range in expected production** (tons/acre/year). The common cultural practice in most of Montana is to manage for two cuttings. You should obtain an estimated low and high total irrigated hay production value in the context of a specific hay type representative for the SSA in question, e.g., grass hay, grass-legume, or all legumes (alfalfa).

> Example: If the range in production for grass-legume hay is 1.5 to 3.5 tons, a method to array the identified soil components is to sort them by barley yield, assigning the lowest 1.5 tons and the highest 3.5 tons and prorate those in between, rounding to 0.1 tons.

As detailed in the forage types mentioned above, there are many exceptions to any set of rules, but this process should give you a firm foundation upon which to make adjustments and refinements.

Step 4: Very important! Once you have the list arrayed and modeled, you need to obtain objective **review for reasonableness and calibrate** the tons/acres assigned in the context of feedback from the District Conservationists, County Agents, and others who have local insight into irrigated hayland productivity in the area. Production values can easily be factored up or down a bit, based on expert input to your model, using calculated columns in a spreadsheet, for example.