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Chair of the Montana Land Information Advisory Council  
Montana State Library  
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To Members of the Montana Land Information Advisory Council:

The Montana Climate Office respectfully submits the enclosed application to have Climate considered as a framework layer under the Montana Spatial Data Infrastructure. I will be available at the March meeting of the Council to answer questions regarding this proposal, and look forward to the discussion. Thank you for this opportunity.

Sincerely,

Dr. Kelsey Jencso, State Climatologist  
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# Montana Spatial Data Infrastructure Selection Criteria

**Background:** *The Montana Spatial Data Infrastructure* or “*MSDI*” is defined as the technology, policies, standards, and human resources necessary to acquire process, store, distribute, and improve the utilization of geospatial data in Montana.

A *Montana Framework Data Layer* is a State recognized, commonly needed and digitally formatted representation of land information features, natural and cultural that are coordinated, developed, integrated, maintained, and distributed through a community based effort over the geographic area of Montana and are, in the determination of the Montana Land Information Advisory Council and the Geographic Information Officer, significant to a broad variety of users within Montana and the Nation.

The Montana Framework Data can and does include data themes identified in the National Spatial Data Infrastructure and where collaborative opportunities exist, presents an ability to support framework data for the nation.

The MSDI Framework Data selection process should consider these definitions within the context of the defined requirements, qualifiers and criteria.

In order to be considered for inclusion as a MSDI Framework Data layer, data must meet all three (3) Mandatory Requirements and either qualify under the Automatic Qualifiers section or meet the minimum point criteria.

**Theme Name:**

Climate

**Sponsor (Name(s) and Agency(s):**

Dr. Kelsey Jencso, State Climatologist  
Montana Climate Office  
Montana Forest and Conservation Experiment Station  
Montana University System

**Theme Summary:**

The climate theme consists of statewide science-based climate information with two primary data types -- point and raster (gridded) data. The point data product contains daily measurements and serially-complete monthly summaries for a few thousand climate stations. The most common measured elements include minimum temperature, maximum temperature, precipitation, snowfall, and snow depth. Products derived from this record of observation are serially-complete daily point records of observation (1948-2012), an equivalent daily statewide raster product, measures of quality, measures of uncertainty, and ISO 19115 compliant metadata. The climate theme currently contains over 23 million records of observation and over 25,000 rasters (resolution of approximately 200 acres or <1 square kilometer). These products are updated daily, monthly, or yearly depending on the product.

The raster (gridded) data products include a number of common satellite-based terrestrial products. Examples include the Normalized Difference Vegetation Index (NDVI) as a measure of greenness, the Enhanced Vegetation Index (EVI) as a measure of greenness but minimizing canopy background variations. Value-added products derived from these satellite products include evapotranspiration as a measure of evaporation from the ground or vegetated surfaces combined with plant transpiration, the departure of NDVI or EVI from the longtime average as an indicator of drought stress on vegetation, net primary productivity as an indicator of the rate at which all the plants in an ecosystem produce useful chemical energy toward growth, a drought severity index as a relative measure of wetness compared to normal conditions, measures of quality, measures of uncertainty, and ISO 19115 compliant metadata. These products are updated every 16-days, monthly, or yearly depending on the product.

This collection of climate data and information is managed by the Montana Climate Office under the direction of the State Climatologist. The Montana Climate Office strives to work with stakeholders to co-produce and maintain products that can easily be integrated into their workflow while developing new products and innovative uses of relevant climate information.

### **Mandatory Requirements:**

- Is the layer based on state-wide collection and maintenance?  
Yes. Statewide and areas adjacent to Montana that influence Montana watersheds (portions of Idaho, Wyoming, North Dakota, South Dakota, Washington, British Columbia, Alberta, and Saskatchewan).
- Is the layer considered the state recommendation or source for a given theme?  
Yes. In managing a climate theme the Montana Climate Office operates in manner similar to other Montana Spatial Data Infrastructure (MSDI) themes by leveraging existing authoritative sources of data. The cadastral theme utilizes control points that are maintained by a federal agency. The transportation theme utilizes road segments from federal, state, and local sources that are recognized as the authoritative source for that jurisdiction. For the climate theme the Montana Climate Office leverages other authoritative sources of climate data in three ways. First, it enhances these products by ensuring their format and distribution follows the guidelines and accepted practices established for MSDI themes. This includes the addition of persistent identifiers, applying a standardized projection, and producing compliant metadata. Secondly, the Montana Climate Office leverages these data sources to derive new authoritative products specific to Montana, based on peer-reviewed national-level climate research. Thirdly, the Montana Climate Office engages the research, resource management, and business community in exploring new ways of interpreting or applying both assembled and derived climate products for the benefit of stakeholders.

In 2006 the Governor of Montana declared the Montana Climate Office as the climate office for the State of Montana “to serve the public by making climate data readily available to a wide variety of users.” The Montana Climate Office is

the state designated body for climate products, serves as a conduit for climate information between disparate organizations, and provides Montanans with high-quality, timely, and relevant climate information and services. In Montana there are more than a dozen federal or regional entities participating in various aspects of climate information and climate research. No other provider of climate information has within their mission the goal of assimilating, organizing, and disseminating climate information across providers for the benefit of a large and diverse stakeholder community in Montana.

- Does the layer have a documented “best practice” or standard?  
Yes. There are accepted best practices that are documented for some data sets that originate from the federal National Oceanic and Atmospheric Administration (NOAA) and the Natural Resources Conservation Service (NRCS). The Montana Climate Office works to implement best practices published by the Montana Association of Geographic Information professionals regarding metadata, persistent identifiers, and spatial reference. Since there are no standards and few best practices for climate information, a goal of the Montana Climate Office is to establish, document, and promote best practices for climate information.

Yes – proceed to automatic qualifiers or criteria  
 No – the theme cannot be considered as an MSDI theme

**Automatic Qualifiers:**

1. An existing NSDI Framework layer (Documented NSDI layers include: Elevation, Hydrography, Geodetic Control, Cadastral, Transportation, Governmental Units, and Orthoimagery)  
  
<or>
2. A represented layer on an official State Base Map or U.S. Geological Survey topographic map  
  
<or>
3. A mandated geospatial layer by state law

Yes – layer may be proposed as an MSDI theme  
 No – layer may still be proposed as a MSDI layer if it meets the minimum criteria point total below.

**Criteria:** If the layer meets the mandatory requirement above but none of the automatic qualifiers it may still qualify as a proposed MSDI layer by meeting the minimum 24 criteria points established below.

TOTAL: 30 points.

Is the layer a critical component in one or more core state business processes or applications?

- Part of 1 business process or application [2 points]
- Part of 2-4 business processes or applications [5 points]
- Part of 4 or more business processes or applications [10 points]

\* Core business processes or applications listed on Summary Page following the Criteria section.

Does the theme have other state/federal stakeholders?

- 1 other stakeholder [2 points]
- 2-4 stakeholders [5 points]
- 4 or more stakeholders [10 points]

\* Stakeholders listed on Summary Page following the Criteria section.

Are MSDI layers dependent on <or> does this layer underpin other MSDI layers? Which layers? Explain. Max Points [5 points]

Does the layer provide a benefit to the public? List benefits. What segments of the 'public' benefit most? Why? [5 points]

\* Public benefits are listed on Summary Page following the Criteria section.

Is the theme part of the state Land Information Plan? Explain. [5 points]

Yes. While the Land Information Plan is primarily a framework for those entities requesting Montana Land Information Act funds in FY13, the plan also identifies goals that are important to the advancement of the Montana Spatial Data Infrastructure (MSDI) even if an entity is not requesting funding. The Land Information Plan reiterates the intent of the Montana Land Information Act which recognizes the importance of digital

land information for all sectors of Montana society, and the need to ensure that digital land information is (1) collected consistently in accordance with standards, (2) maintained accurately in accordance with standards, and (3) made available in common ways for all potential uses and users, both private and public. The climate theme is consistent with this intent. In addition, the Land Information Plan references the FY13 MSDI work plan which contains a fundamental maintenance goal of establishing a base level of completeness and availability for MSDI themes. Data distribution, including metadata, is to be consolidated at one primary access point. The activities of the Montana Climate Office relative to the climate theme are aligned with this goal. Finally, the activities of the Montana Climate Office are aligned with the intent of Land Plan Priorities Proposed for Funding (B – Grant Categories) Section B3 - Metadata and Data Archival Projects. It is within the Montana Climate Office work plan to develop ISO 19115 and related metadata using the North American profile endorsed by the Federal Geographic Data Committee in August of 2012.

Is the theme currently maintained by a state or federal agency? Which agency? [5 points]

Yes. While the Montana University System is not considered a state agency in the purist sense, it does host the state-designated Montana Climate Office and State Climatologist. The climate theme, though not formally designated, is being maintained by the Montana Climate Office. Currently, federal agencies compile vast databases of temperature, precipitation, wind speed, and other measures. That information is not tailored for Montana nor do any other entities provide the custom information Montanans need to make governance, business, and personal decisions. In that sense, no other federal or state agency currently meets the definition or criteria of maintaining a climate framework theme for Montana. It is the case that no other provider of climate information has within their mission the goal of assimilating, organizing, and disseminating climate information across providers for the benefit of Montana stakeholders. It is also the role of the Montana Climate Office to assist stakeholders seeking assistance in interpreting climate information or adapting climate products to their needs. It is the goal of the Montana Climate Office to fulfill the need and responsibility of maintaining a statewide climate theme.

Does the layer have a state sponsor/steward? Who? [5 points]

Yes. In 2006 The Montana Climate Office within the Montana University Systems' Montana Forest and Conservation Experiment Station was established as the climate office for the State of Montana by Governor Brian Schweitzer. The Director of the Montana Climate Office is designated as the State Climatologist. The Montana Climate

Office is actively completing the application process to be identified by the American Association of State Climatologist (AASC) as the nationally recognized climate office for the State of Montana. The AASC application process requires approval of the National Weather Service offices within the State of Montana, and a letter of support from a leading administrator (Lt. Governor Walsh). The Montana Climate Office expects to successfully conclude the application process in April 2013 with full acceptance by AASC.

## SUMMARY PAGE FOR CRITERIA

Is the layer a critical component in one or more core state business processes or applications?

Yes. Four identified:

- In October 2012 the Montana Climate Office (MCO) met with staff from the Montana Department of Environmental Quality (DEQ) to identify MCO products that can contribute to business process or application within DEQ. The products fell into two categories: (1) transforming existing products into formats that are easily utilized by DEQ staff in their workflow, and (2) the delivery of new products. Transforming existing climate theme products include the delivery of daily climate station data, monthly serially-complete climate station data, statewide measures of greenness or enhanced greenness, and evapotranspiration. New products produced by the MCO include the delivery of daily serially-complete climate station data, gridded daily minimum temperature, gridded daily maximum temperature, gridded daily precipitation, measures of uncertainty, and departure of greenness.
- In October 2012 the Montana Climate Office (MCO) met with staff from the Montana Department of Fish, Wildlife, and Parks (FWP) to identify MCO products that can contribute to business process or application within FWP. FWP had requests that were consistent with the requests made by the Montana Department of Environmental Quality (DEQ). FWP also requested the addition of a new product produced by the MCO that portrays drought severity, expressed a need for down-scaled climate projections that drive changes in species and habitat distribution, and a need for an assessment of water supply. These products are in development.
- In February 2013 the Montana Department of Natural Resources Water Resource Division DNRC asked if the Montana Climate Office can contribute to the 2015 State Water Plan (MCA 85-1-203). Specifically, contributing the likelihood of drought that can be applied to a risk management\assessment, and how that likelihood varied during various regional climate patterns.

- The Montana Climate Office is developing measures of greenness and departure of greenness at a 16-day interval, and a new high-resolution statewide Drought Severity Index to supplement the information base utilized by the Governor’s Drought and Water Supply Advisory Committee (MCA 2-15-3308) for determining the status of drought conditions in Montana.

Does the theme have other state/federal stakeholders?

Yes. Four identified:

- In November 2012 the Montana Climate Office (MCO) staff met with the federal Missoula Office of the National Weather Service (NWS) to determine areas of mutual interest for climate data. NWS expressed an interest in collaborating with the MCO in areas of investigation of mutual interest. The NWS identified the MCO products of gridded daily minimum temperature, gridded daily maximum temperature, gridded daily precipitation, measures of uncertainty, greenness, departure of greenness, and evapotranspiration as products that would be useful to their operations.
- In November 2012 the Clark Fork River Basin Task Force (MCA 85-2-338) expressed concern with the amount and timing of the water supply in the Clark Fork River Basin, and short-term and long-term water management issues. The Montana Climate Office is pursuing the development of climate and water supply products that can contribute to basin-level assessments within Montana.
- In December 2012 the Montana University System Water Center (Montana State University) has requested the assistance of the Montana Climate Office in utilizing MCO products to provide Montana citizens and policymakers with accurate, science-based information on water availability and drought conditions through development of predictive tools emphasizing precipitation, drought, and other water availability data through their web presence.
- In February 2013 the Montana University System Soil Fertility Extension Program expressed an interest in how satellite products can supplement soil fertility management and gear the information toward extension agents, crop advisors, farmers, and ranchers.

Does the layer provide a benefit to the public? List benefits. What segments of the ‘public’ benefit most? Why?

Yes. The climate theme provides a benefit to the public in both direct and indirect ways. Climate products produced by the Montana Climate Office are utilized to assess how



climate variability impacts Montana's natural resources, ecosystems, regions and industries including agriculture, tourism and other human activities. Climate products also provide a basis for developing and recommending mitigation strategies that can be implemented by businesses, agriculture, public health officials, municipalities, wildlife managers, non-governmental organizations, and other stakeholders. The public benefits by vastly improved access to climate information pertinent to Montana, and through interfaces to deliver climate information by administrative boundaries such as counties, and hydrologic boundaries such as major watersheds. The Montana Climate Office regularly receives inquiries from the public regarding climate data. Two recent examples are (1) the relationship of the local long-term climate record to long-term records of recreational ice conditions in a neighborhood park, and (2) the relationship of the long-term climate record to insect infestations.

Other general examples:

- **Agriculture:** Assist in determining the relative production of dry-land agriculture and the need for irrigation by evaluating growing degree-days, measures of vegetation greenness, departure of greenness, and evapotranspiration.
- **Communities:** The timing and magnitude of water availability in the context of changing water uses may increase demands on local water resources. Extreme events may also test the capacity of communities to adapt to storm events. Montana towns also need to know how their water resources are being affected by a combination of changing temperatures and precipitation as well as impacts of increased water use by resource extraction and exurban development.
- **Forestry:** The ability to monitor periods of extended drought will municipalities in mitigating the impact of more frequent and more severe wildfires due to drier forests, with important impacts on air and water quality and human health.
- **Tourism:** Less snowpack will decrease spring runoff and warm streams, decreasing suitable trout habitat, closing rivers to fishing and affecting winter recreation in the state's multi-million dollar tourism industry.
- **Transportation:** More erratic and extreme storms will lead to flooding and increased damage to the state's infrastructure, such as roads and bridges.
- **Energy:** Energy production may alter water availability for agriculture and communities. In addition, decreasing water availability may put significant constraints on Gas, oil and mining operations.