International Forest of Friendship Newsletter
March 2015--"Flying and Forests"

Welcome to this second edition of the Forest's newsletter! The focus is on plans for the Forest's 39th year (www.ifof.org) and for the June 19-20 (Fri-Sat) celebrations. Within the Forest's overall theme of "World Friendship through Flying," the particular emphasis this year will be ""Flying and Forests," linking Earth's green spaces with aviation and aerospace. Please plan to come--it will be a terrific weekend. The content of this newsletter is:

The Scope of "Flying and Forests"

This topic combines several areas, such as smokejumpers, wildland fire aviation, remote sensing and analysis of forests and other ecosystems, forest and habitat management, precision agriculture, and other activities. These are exceptionally rich and diverse categories, and the brief descriptions below only scratch the surface.[1] **As you read through them we hope they will suggest honorees (and outreach opportunities) to you in any of these areas** as well as traditional honorees who have contributed to all other aspects of aviation and aerospace.

Smokejumpers

[1] The notes have been compiled from many sources, including e-mails & websites—references available on request.

The smokejumper program is managed at the National Interagency Fire Center (www.nifc.gov) in Boise, ID, the nation's support center for wildland firefighting. The predecessor of NIFC was created in 1965, and now includes eight different agencies and organizations. Decisions are made using the interagency cooperation concept because the NIFC has no single director or manager.

Smokejumpers are firefighters who are transported to fires by airplane and parachute. They can get to remote fires safely and quickly, and work to keep high-risk fires small. All smokejumpers are dispatched through the National Interagency Coordination Center (NICC), http://www.nifc.gov/nicc/, which is part of NIFC.

The US has a total of more than 400 smokejumpers. Some 23 are women. Smokejumping in the US dates from 1939, with Rufus Robinson and Earl Cooley making the first fire jump on July 12, 1940 into the Nez Perce National Forest in Montana. There are nine jump bases in the US: two under the Bureau of Land Management (BLM), in Boise and Fairbanks, Alaska, and seven under the US Forest Service (Winthrop, Redmond, Redding, McCall, Grangeville, Missoula, and West Yellowstone). The Boise jump base employs about 80 to 85 smokejumpers every season.

Smokejumpers require special training and a high level of physical fitness. Once they have completed their fire mission, smokejumpers pack out their gear, which can weigh 110 pounds or more. A load of smokejumpers takes about eight minutes to get suited up and into the air after being dispatched.

Since 1939 more than 5,000 men and women have served America as smokejumpers. More than 30 have been killed in the line of duty. Read their stories at: http://smokejumpers.com/index.php/killedinthelineofduty/get

The National Smokejumper Association (smokejumpers.com/index.php) is dedicated to preserving the history and lore of smokejumping, maintaining and restoring America's forest and grassland resources, responding to the special needs of smokejumpers and their families and advocating for the program's evolution.

Wildland Fire Aviation

Wildland fire aviation includes a variety of aircraft and operations. Helicopters are used to drop water, transport crews, provide reconnaissance (including with infrared sensors), and deliver resources to the fireline. Fixed-wing aircraft include smokejumper aircraft, air tactical platforms, Single Engine Airtankers (SEATs), large airtankers, and large transport aircraft. These aircraft play a critical role in supporting firefighters on the ground.

The National Interagency Coordination Center (NICC) is the sole dispatch center for heavy airtankers, lead planes, smokejumpers, hotshot crews, Type 1 Incident Management Teams, area command teams, medium and heavy helicopters, infrared aircraft, military resources,

telecom equipment for fires, Remote Automated Weather Stations (RAWS), and large transport aircraft.

Interagency Airspace Coordination procedures are used so land management agencies can safely use the National Airspace System. Participants include the Air National Guard, National Park Service, BLM, US Forest Service (USFS), Departments of Interior & Homeland Security, Customs and Border Protection and various States. New rules recently have been issued by the Federal Aviation Administration (FAA) for Unmanned Aircraft (or Aerial) Systems (UAS).

In 2014 there were 11 tankers on contract, including two very large DC-10s. The year before the NICC website listed over 35 leadplane pilots. In 2015 there were 18 smokejumper aircraft. There also are "call when needed" helicopters and other aircraft. USFS has issued requests for information (RFIs) concerning the acquisition of new firefighting aircraft.

The Modular Airborne FireFighting System (MAFFS) is a self-contained aerial firefighting unit that can be loaded onto a military C-130 cargo transport, which can then be used as an airtanker. This lets the USFS use Air National Guard and the Air Force Reserve aircraft as an emergency backup resource for the civilian airtanker fleet. Members of the crew of MAFFS 7, who were killed fighting fires in South Dakota, were honored at the Forest in 2013.

In addition, CAL FIRE (http://calfire.ca.gov) has an emergency response aviation program that is considered very effective and is a model for fire fighting agencies around the world. The air program supports CAL FIRE's ground forces and includes 23 Grumman S-2T 1,200 gallon airtankers, 11 UH-1H Super Huey helicopters, and 14 OV-10A airtactical aircraft. A few of the aircraft are kept as maintenance relief. From 13 air attack and nine helitack bases located statewide, aircraft can reach most fires within 20 minutes. The airtactical planes fly overhead

directing the airtankers and helicopters to critical areas of the fire for retardant and water drops. The retardant used to slow or retard the spread of a fire is a slurry mix consisting of a chemical salt compound, water, clay or a gum-thickening agent, and a coloring agent. While both airtankers and helicopters are equipped to carry fire retardant or water, the helicopters can also transport firefighters, equipment and injured personnel.

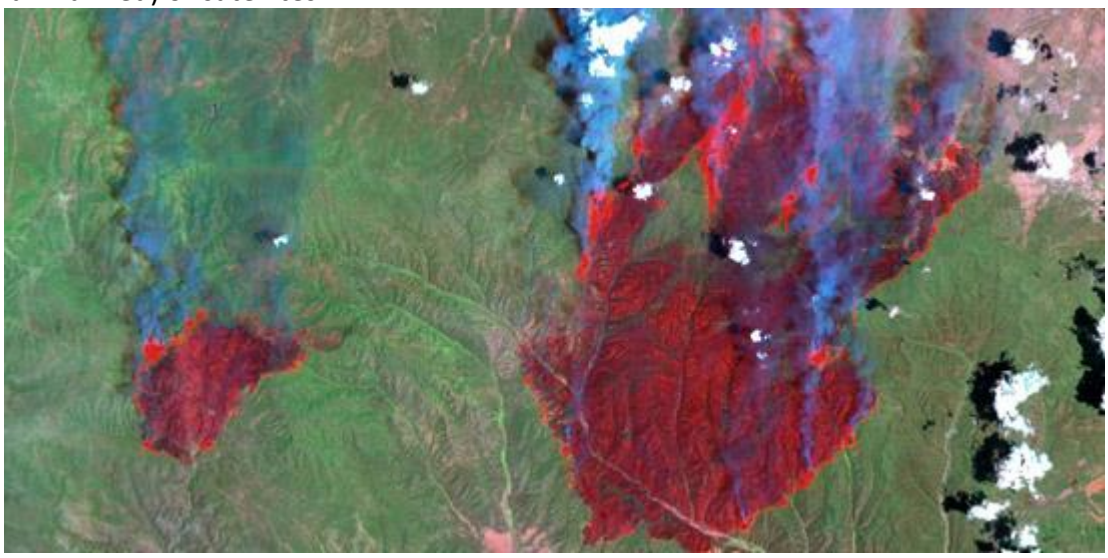
The Association of Aerial Firefighters (AAF), www.airtanker.org, serves members who have a common interest in the aerial firefighting industry, which includes: fixed and rotary winged aircraft that a) drop fire retardant, foam or water, b) fly in a lead plane or tactical air-control capacity and/or c) provide logistics support of personnel deployment missions at fire incidents. It seeks to provide a safer and more efficient aerial firefighting environment and to improve the social welfare of the pilots, crew members and families.

Remote Sensing and Analysis of Forests and Other Ecosystems

Geospatial Tools Overview

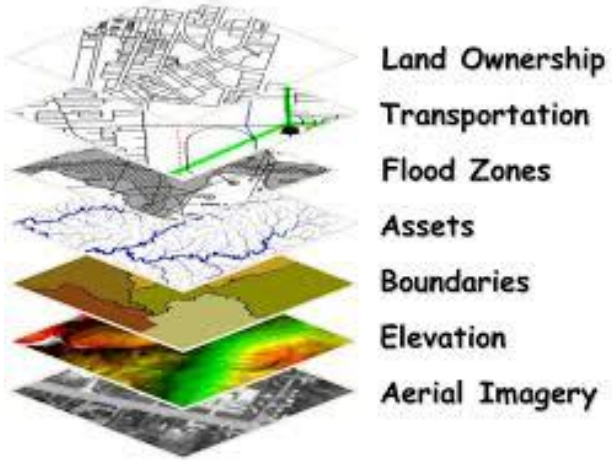
Geospatial tools fall into three broad categories: Remote Sensing, Geographic (or Geospatial) Information Systems (GIS) and Position, Navigation and Timing (PNT) systems

- Remote Sensing provides a view of the world. For example, forest canopy changes can be mapped using remotely sensed images, which could come from aircraft (manned or unmanned) or satellites.



- GIS store and manage information about the world, such as boundaries and attributes for a project area. Attributes could include vegetation/land cover, land ownership, transportation features, soils, elevation, etc. They integrate maps and information and can be used to answer questions like: when and where did changes occur? How much has changed? They also can be used to model outcomes and alternatives.
- PNT systems determine location and provide time and can be used to navigate and collect site-specific information. The Global Positioning System (GPS) is a widely used

PNT system that uses satellites to determine latitude, longitude and elevation. Many GPS units are portable, work in remote locations and can export data into GIS.



GIS Information Layers

PNT (GPS) Receiver

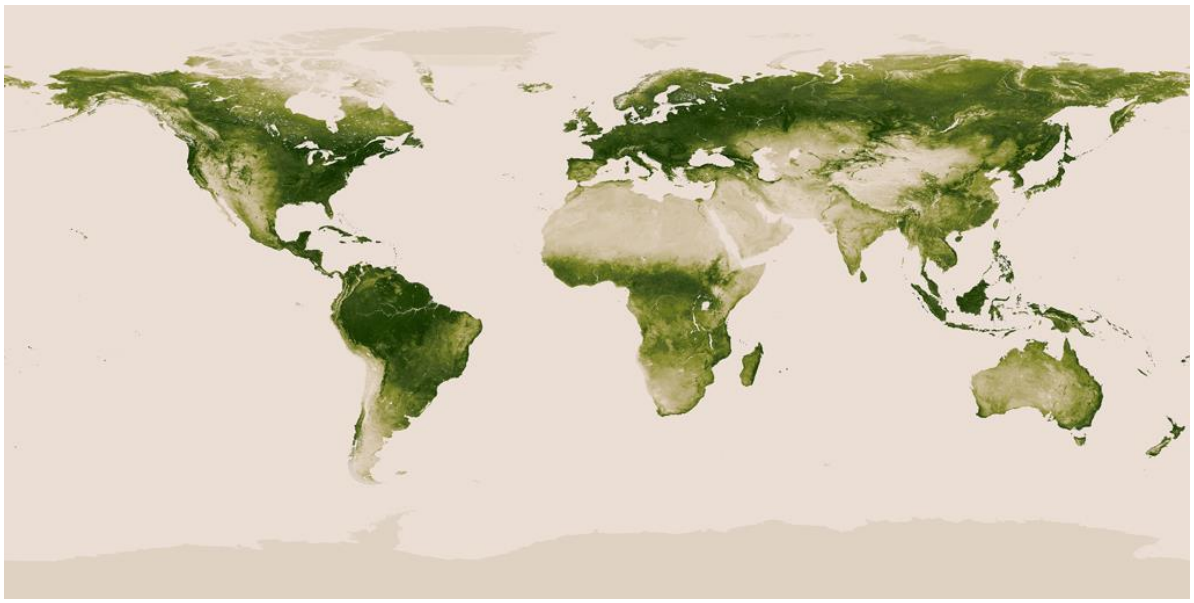
Practitioners

Many public and private organizations, and individuals, around the world are involved in the remote sensing and analysis of forests and other ecosystems. These include the U.S. National Aeronautics and Space Administration (NASA), the U.S. National Oceanographic and Atmospheric Administration (NOAA), the European Space Agency (ESA) and the U.S. Forest Service's Remote Sensing Applications Center (RSAC).

NASA's Earth Science Division (http://science.nasa.gov/earth-science/) maintains a coordinated series of satellite and airborne missions for long-term global observations of the land surface, biosphere, solid Earth, atmosphere, and oceans. The purpose of NASA's Earth science program is to develop a scientific understanding of Earth's system and its response to natural or human-induced changes, and to improve prediction of climate, weather, and natural hazards.

NOAA (http://www.noaa.gov/) "is a scientific agency within the US Department of Commerce focused on the conditions of the oceans and the atmosphere. NOAA warns of dangerous weather, charts seas and skies, guides the use and protection of ocean and coastal resources, and conducts research to improve understanding and stewardship of the environment. It maintains the National Environmental Satellite, Data, and Information Service (NESDIS) to operate and manage the United States environmental satellite programs, and manage the data gathered by the National Weather Service and other government agencies and departments. "

The International Forest of Friendship's home page (www.ifof.org) shows a NASA/NOAA composite image of vegetation across the planet:



(http://blogs.discovermagazine.com/d-brief/2013/06/24/a-map-of-all-the-plants-on-earth-photo/#.VKtlBIvF-So)

The Forest Service's Remote Sensing Applications Center (RSAC) (http://www.fs.fed.us/eng/rsac/) is located in Salt Lake City, Utah, and co-located with the agency's Geospatial Service and Technology Center (GSTC). Guided by national steering committees and field sponsors, RSAC provides national assistance to agency field units in applying the most advanced geospatial technology toward improved monitoring and mapping of natural resources. RSAC's main goal is to develop and implement less costly ways for the Forest Service to obtain needed forest resource information. RSAC programs provide technology evaluation and development and training support in the use of remote sensing, GIS, image processing, and GPS for all resource applications with primary emphasis on ecosystem management.

In addition to governments there are some outstanding private sector efforts, such as the Carnegie Airborne Observatory (CAO) http://cao.carnegiescience.edu. The CAO's mission is "To explore and conserve Earth's amazing ecosystems with advanced 3-D spectral and laser imaging technology." The TED Talk "Ecology from the Air" by CAO's principal investigator Greg Asner (http://www.ted.com/talks/greg_asner_ecology_from_the_air) is fascinating.

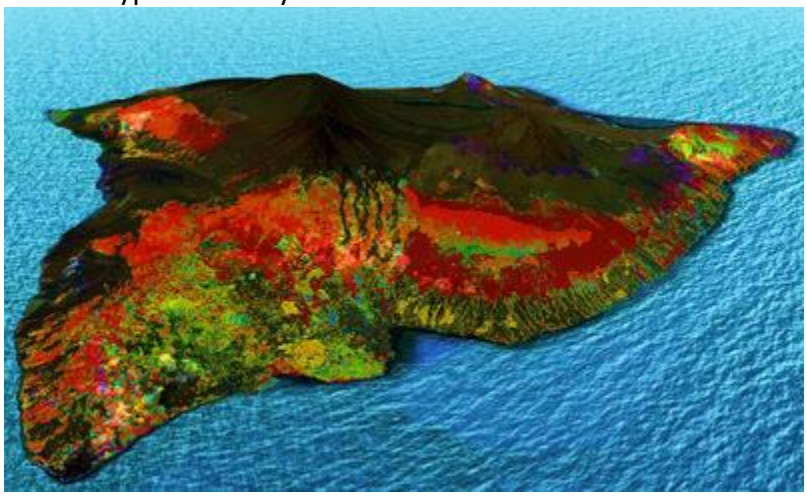
Forest and Habitat Management

Monitoring the World's Forest Resources and Forest Health

Demand for forest wood products, conversion of forest land to other uses, and concerns about climate change have increased the focus on the world's forests. In addition, programs such as the United Nation's Reducing Emissions from Deforestation and Forest Degradation (REDD+) have been developed which potentially allow for the exchange of money or credits for preserving forests within developing nations. This creates a need to monitor, report, and

verify a country's efforts to preserve and potentially increase their forest land. See http://www.fs.fed.us/eng/rsac/programs/monitoring.html

Another example, from CAO imagery, is this view of carbon stocks across more than 40 distinct types of ecosystems on the island of Hawaii.



Reforestation

Green Belt Movement (GBM), http://www.greenbeltmovement.org/, is an environmental organization that empowers communities, particularly women, to conserve the environment and improve livelihoods. GBM was founded by Professor Wangari Maathai in 1977 in Kenya to respond to the needs of rural Kenyan women who reported that their streams were drying up, their food supply was less secure, and they had to walk further and further to get firewood for fuel and fencing. GBM has been engaging in climate change activities especially focusing on increasing understanding of climate change and forests (REDD+) approaches both at the local community and national. In 2004 Professor Maathai became the first African woman to win the Nobel Peace Prize. A graduate of Benedictine College in Atchison, she was inducted into the IFOF in 2012.

Aerial reforestation has been used in the United States since at least the 1930s. But it's harder than it seems, and many of those efforts were not successful. For example, it is hard to drop seedlings from high altitude without damaging fragile root tips. Several designs now exist that encase seedlings in sturdy but biodegradable cone-shaped containers. The containers are strong enough to protect the seedlings when they hit the ground yet still disintegrate to let the trees' roots emerge. They're also packed with everything the seed or seedling needs for survival. Placement also is important—seeds or seedlings must reach fertile ground, so hospitable locations must be identified and the payloads delivered accurately. People have considered applying techniques the military uses for precise weapons delivery. The proliferation of inexpensive GPS-guided devices also can help.

In Mexico, officials at Izta-Popo National Park near Mexico City have conducted several airdrops of seed spheroids, (the name for their particular design of seed canister) to

reforest the area. The Mexican National Forest Commission has also been testing aerial reforestation with its own version of seed packages to see if they might use it in future projects. In early 2008 about 400 volunteers in Louisiana built their own seed containers by wrapping seeds, sand and soil in gauze dipped in candle wax. The containers were then strategically dropped out of a helicopter along the state's southern coast.

Proponents of large scale aerial reforestation think it contribute to reducing atmospheric carbon dioxide by helping to replace some of the 50,000 acres of trees that reportedly are lost worldwide each day. A related concept called "afforestation" refers to planting forests or stands of trees where forests didn't exist before.

Precision Agriculture

Precision agriculture (PA) or site-specific crop management (SSCM) is a farming management concept based on observing, measuring and responding to variability in crops within and between fields. It is very data-intensive. Crop variability typically has both spatial and temporal components which complicate data gathering and analysis. The holy grail of precision agriculture research will be the ability to define a Decision Support System (DSS) for whole farm management to optimize returns on inputs while preserving resources. The reality today is that it is hard to define even seemingly simple concepts such as management zones--areas where different management practices will apply for a single crop type on a single field over time. Among the many approaches is one which ties multi-year crop growth stability and characteristics to the shape of the terrain (it's called phytogeomorphology). Multi-year datasets are now becoming available that show this stability and its effects, but much work remains to create an actual DSS system that could universally help farmers.

Modern high resolution, multi-spectral, precisely targeted imaging, enabled by GPS and GIS can provide information of great value to agriculture, for example by identifying plants that are under varying degrees of stress, measuring soil moisture, and assessing the need for fertilizer.

Unmanned Aircraft Systems (UAS), which combine Unmanned Aircraft Vehicles (UAVs) with their payloads and support systems, are important new instruments for precision agriculture. UASs typically fly close above farm equipment but well below manned aircraft. They can operate as low as 100 feet above ground level (AGL), while small, manned aircraft usually operate above 1,000 feet. Of course, satellites are much farther away. Clearly, lower altitudes offer significant resolution advantages and some UAS images can discriminate less than an inch, with the camera quality and altitude being the critical variables. Also, UAS images may be collected under cloud cover, and one UAV can cover approximately 1,000 acres in an hour. UAS images often can be accessed more quickly and at lower cost than those from traditional aircraft used to survey fields. Moreover, data from a UAS payload often can be downloaded quickly to a tablet or smartphone, allowing researchers to evaluate information quickly and effectively.

The rules for using UASs still are being worked out. For example, some universities hold certificates of authorization from the Federal Aviation Administration (FAA) to operate UAVs for research purposes, and scientists are using the aerial equipment in research related to

irrigation, plant growth, nutrient management and herbicide application. FAA officials are developing regulations for the commercial use of UAVs and Congress has set a September 2015 deadline for the agency to establish rules specifically for small, unmanned aerial systems. So far, the aerial equipment has been approved for commercial use only in very limited capacities.

Other Activities

The "Partners in the Sky" program (http://smithsonianscience.org/2014/03/partners-in-the-sky/) brings aviation and aerospace leaders together to build partnerships around worldwide conservation efforts that will revolutionize animal tracking. Scientists at the Smithsonian Conservation Biology Institute (SCBI) have been working with aviation and aerospace leaders, led by Airbus Americas, Inc., in a unique public-private partnership. It links four key elements: (1) Satellite technology to track animals anywhere; (2) the "one-gram challenge" to miniaturize tracking devices; and (3) a wide network of commercial aircraft equipped to collect data and automatically download it to the ground, all tied together by (4) big data analytics to create a first-of-its-kind global animal tracking system. Aviation and aerospace companies are volunteering their resources to help track the movement of thousands of animals, using technologies and programs similar to those they use every day. Future efforts will work to make the satellite solution more affordable; develop high-power, one-gram tracking devices; and engineer, build, and certify an aircraft antenna to pick up tagged wildlife on overfly routes. The goal is to place these tools in the hands of researchers who can lead the way discovering *why, how, where, and when animals move*. Ultimately, knowledge of migratory connectivity, infectious disease, poaching, wildlife trafficking, and human-wildlife conflict such as bird strikes with aircraft can be used to benefit current and future societies

OpenDroneMap (http://opendronemap.github.io/odm/#) is an open source toolkit for processing raw imagery from small civilian UAS, balloons, kites, etc. to produce useful geographic products. In addition to very high resolution (2-4 cm), three-dimensional modelling ODM can be used for rapid surveys of the impact of severe weather or other disasters on farmland and infrastructures. The one-minute video at: https://www.youtube.com/watch?v=0UctfoeNB_Y provides an excellent overview. ODM is closely related to the Free and Open Source Software for Geospatial (FOSS4G) movement.

ACETA (Aerial Capture, Eradication and Tagging of Animals) helicopters associated with the Fish and Wildlife Service provide another link between aviation and the planet's green spaces.

Next Steps

These are only a fraction of the activities underway worldwide. We hope that 2015 Flying and Forests theme will spur the development of partnerships between the Forest and many other organizations. In addition to activities around Atchison, this could be an excellent chance to forge ties with agriculture-based businesses, as well as other aviation and aerospace organizations in Kansas. We'd like to strengthen ties with Wangari Maathai's Green Belt Movement going forward, as well as work with the Explorers Club in their explorations of the

biosphere, and leverage the explosion of opportunities in open source GIS development. The use of aviation, remote sensing and related data analysis in precision agriculture could be a collaborative area. Another potential set of ties would be to sponsor educational projects, particularly in STEM (Science, Technology, Engineering, and Mathematics) areas, in conjunction with organizations like Rotary International, Challenger Center, Young Eagles, Girls Fly, etc. In sum, this could be a very rich year for cooperation.

We would welcome discussions on these topics with anyone or any organization that's interested and would like to explore several types of relationships going forward:
(1) Building an interest with individuals and partner organizations in the "Flying and Forests" events in June 2015;
(2) Encouraging participation in ongoing Forest activities; and
(3) Developing an understanding of how we might work with partner individuals and organizations on future activities at the Forest. Upcoming themes include:

2016: "World Friendship through Flying"—Focused on international activities and the Forest's 40th year.
2017: "Flying, Forests, and the Future"-- Emphasizing contributions by people under 35.
2018: "Security and Solace through Flight" – Especially military aviators, flying medical staff, Angel Flight, etc.
2019: "Discovery through Flight" – Honoring those who have "pushed the envelope" in all aspects of aviation and aerospace.

We'd greatly appreciate your feedback on any aspect of the Forest and this newsletter. Suggestions for honorees and outreach opportunities would be welcome. Please feel free to reply directly to the transmittal e-mail (forestoffriendship@gmail.com) or via the website (www.ifof.org) which has more information about the Forest and points of contact, as well as sponsoring and reservation procedures. Other contact information is:

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All the best.

Pat Carrigan and Lin Wells
Co Chairmen

Help us keep the Forest Growing! The Forest is a 501c3 and your donations can help sustain the Forest's upkeep and improvements. There's a PayPal link on the website for your convenience.