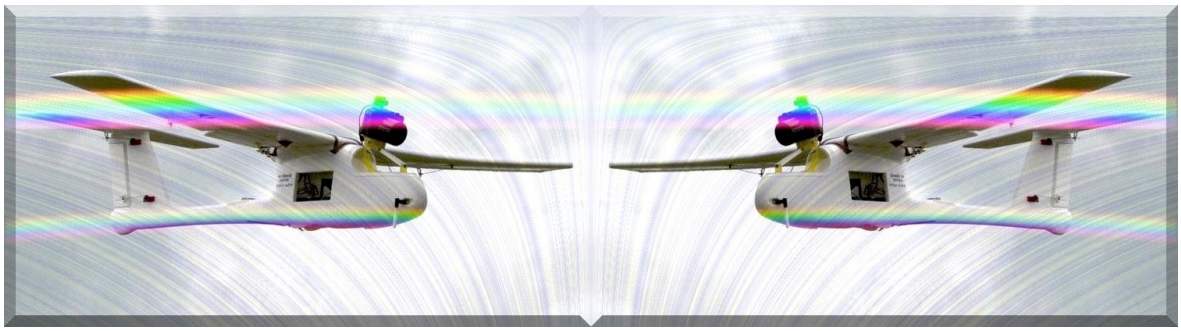
DRONES IN SERVICES FOR ENVIRONMENTAL PROTECTION, MONITORING, MAPPING AND OBSERVATION OF AGRICULTURAL CULTIVATION.



INTRODUCTION

2015 we will start to use drones for remote sensing in the context of environmental and agricultural research. This project is carried out in the Mexican states Oaxaca and Jalisco. A Drone is an Unmanned Aerial Vehicle (UAV) or Unmanned Aircraft System (UAS).

Drones are publicly perceived like military equipment, for surveillance, espionage and for drug trafficking. This is very unfortunate, because drones are also good tool for various legal civilian applications. The use of this technology facilitates the access to environmental data to communities in rural and remote areas as well as for environmental organizations and groups involved in scientific research.

CAN YOU USE DRONES ALSO IN YOUR PROJECT OR TARGETED AREA?

We are interested to work on it with as many potential partners as possible. That's why we ask you to consider whether the use of drones would be very useful in one of your project activities and thereby reduces costs? Please read the following lines in which we describe the advantages of unmanned aircrafts.

WHY DRONES?

Civilian drones have great potential in many different areas of work, because it can move quickly over uneven or rough terrain and overcome any obstacle offering bird's eye imagery and other information

obtained by different sensors. The use of this technology facilitates the fast access to spatial data. For this reason it is interesting for science active in the field of ecology and environment, for farmers harvest surveys, for construction work, for groups and organizations with few financial resources and projects with the population in rural areas. Drones can be used in forest ecology, water management, planning and monitoring of sustainable agriculture, environmental planning and projects in the context of climate change (quantification of carbon sequestration). They are also suitable for fast initial damage surveys in disaster situations such as forest fires, hurricanes and floods.

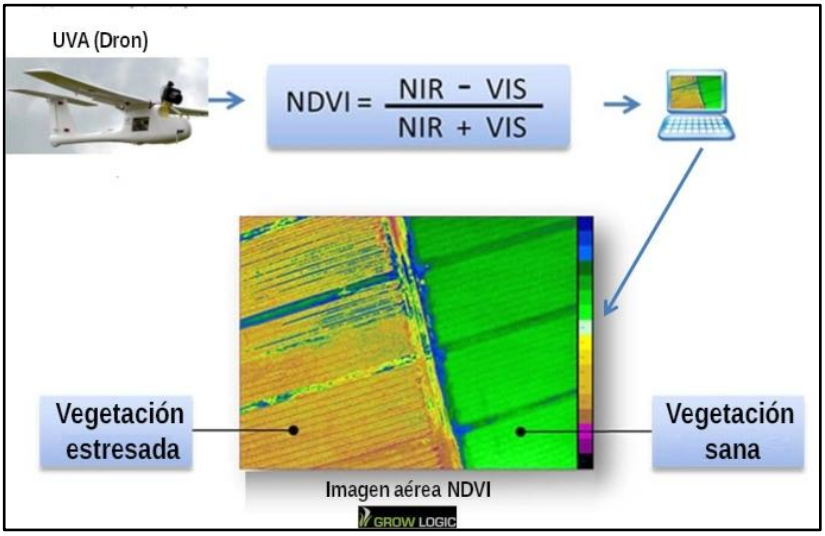
BENEFITS OF AERIAL PHOTOGRAPHS WITH DRONES ARE:

- The production of images by drone can be adapted to the needs of the study area.
- The recording time can be determined.
- The satellite images are filtered by the atmosphere and this distortion must be corrected which is a very hard work and often lead to incorrect results. Drones prevent these distortions largely due to the low flight altitude while taking photos.
- The resolution of the images is very fine, because the images are taken from a low altitude.
- The gathering of images and data is inexpensive.
- Create independence because production is in your own hands.
- It is relatively easy to train people in this technology.
- All records are georeferenced.

WHAT KIND OF INFORMATION CAN BE MADE WITH DRONES AND FOR WHAT USE IS THIS?

1. Forest coverage and analysis of forest condition.
2. In studies on the state of the vegetation and its composition though aerial photography by drones.
3. Control and monitoring of the state of crops for agricultural management planning.
4. In agriculture and forestry drones can be used for early detection of abnormalities such as stunted grow due to nutrient deficiency, "pests" or chronic water shortages.
5. Projects in the context of climate change (Quantification of carbon sequestration, to obtain base lines).
6. Obtain the normalized difference vegetation index (NDVI)
7. Normalized Difference Water Index (NDWI)
8. In watersheds drones can be used for their analysis, planning and management.

9. Environmental spatial planning at community level and for ecological planning of their territories.
10. 3D terrain models with high resolution.
11. Applications LIDAR (Laser Imaging Detection and Ranging)
12. Orto-photography at low altitude.
13. Photogrammetric.
14. Oblique photographs.
15. Air Video at low altitude.
16. Collecting data in hard to reach places. For example to gather rapid data on damages in disaster areas such as after forest fires, hurricanes and excessive flooding. Identification of risk areas in the context of landslide hazards.
17. Control and monitoring of industrial accidents with toxic waste in aquatic and terrestrial environments; control storage areas and industrial waste storage and treatment plants.
18. Monitoring of surface mining activities and its environmental impact.
19. Control and monitoring of large construction sites.



¿ WHAT PRODUCTS CAN BE PREPARED WITH DRONE

- Mosaic of aerial photographs of the area of interest.
- Digital elevation model (DEM) and topography with contour lines every 10 centimeters.
- High resolution aerial orthophotography.
- Normalized Difference Vegetation Index (NDVI)
- Normalized Difference Water Index (NDWI)

- Integrating of the data obtained by Drones into Geographic Information Systems (GIS) and statistical analysis and interpretation of these data.
- Oblique aerial photograph and panoramic shots.
- Aerial video shots.
- In disasters Situaciones drones allow a rapid risk analysis and create rescue plans. Data can be quickly acquired flying over the affected area. All cameras (including video cameras) are equipped with GPS. This facilitates in disaster areas the location of the critical points.
- We can help you in the field of GIS in your project. We have extensive experience in processing and proper interpretation of satellite images of the main sensors (Landasat, SPOT, Rapid Eye).

THE COSTS ARE VERY REASONABLE!

The low cost of these drones compared to the cost of traditional vehicles and man days' work make them ideal for these tasks (a traditional vehicle is more expensive, and pose a risk of human life, high fuel consumption, permits etc). Think of how the use of drones helps to reduce costs for the project implementation. One of our goals is to keep costs down without compromising quality.

DATA OBTAINED FROM DRONES SHOULD BE FREELY AVAILABLE.

We support the efforts of countless researchers around the world making remote sensing data freely available. Data collected with drones, whenever possible, should be freely available and will be bound to the idea of "Creative Commons", of course, with strict protection of personal rights and privacy. Through our long experience in the field of Geographic Information Systems (GIS) we are well connected to exchange information and experiences with others partners around the globe. A monopolized and enclosed application of this technology would be, in our opinion, counterproductive and harmful to any development. We are convinced that networking and the free exchange of knowledge and experience has a greater dynamic of creativity and innovation that foreclosure monopoly. If we act now, we are able to achieve this goal with our own hands and thereby positioning us permanently in this field of work. For this reason, we will set up an Internet platform for exchange and networking purposes. The information obtained will be managed transparently on this platform and will be freely available.

LET'S START NOW WITH DRONES!

It is a good time to use drones as a tool and additional useful equipment in project implementation. The market of drone use is exploding. Mainly in the field as "toy drones" but increasingly also in the professional field. In Mexico there is currently still a chance to try to "democratize" this technology. Under democratize we understand that technology is economically affordable and that the greatest number of users can apply it. Both things are interrelated. There are many other reasons that we want to examine in more details below.

EASY ACCESS TO SPATIAL DATA.

Remote sensing data (satellite data, aerial photography) are indispensable information in protecting the environment in general and in particular for planning of agricultural and forestry activities, water management (basins) and regional planning at community level. We are working in Mexico with satellite imagery and aerial photography for more than 25 years. In the last 10 years spatial visualization has exploded and became commonplace. Google Maps, Google Earth and Open Street Map is installed on almost any Smartphone and can be viewed from anywhere with Internet access. The same applies to services associated with location through GPS.

THE DEVELOPMENT OF PROFESSIONAL REMOTE SENSING.

The services described above are not enough for professional use. But also in the professional field the use of spatial data development did not stop. Satellite imagery for the investigation of ecosystems is now much more accessible than 10 years before. Similarly, the number of users is "exploding". Geographic Information Systems (GIS) have become a common good and is not only available for a small esoteric circle. The access to individual software has expanded enormously and has experienced rapid development in the area of open source and free software. This is basically very promising, but it also brings some challenges. Today, almost anyone can download a satellite image from the Internet and process it using GIS software. Proper treatment of satellite images is complex and requires experience. Today, much more information is generated as before but quite often with very poor quality due to lack of experience and expertise.

DEVELOPMENT IN THE MARKET FOR AERIAL PHOTOS AND SATELLITE IMAGES.

Professional processing of remote sensing data remains to be complex. In the last decade, demand for satellite images and high resolution aerial photographs has increased. These high resolution images are now widely available, but usually prohibitive in price or not accessible at the required time. In Mexico some state and academic institutions have access to these high resolution photos but the access is extremely difficult because of monopolistic policies of those institutions. This in contrast with the opening to access to spatial data worldwide. Now we face the fact that, first, all images and data files from NASA are freely available including networks of users to exchange data. On the other hand, private companies sell satellite images, which have a higher optical density of information. The best example are the SPOT satellites of the French Space Agency CNES which even Google Earth gets its images. The CNES sells its photos through the company Astrium, which in turn is a subsidiary of Airbus. The prices of this material are very high. This means that users or groups with few financial resources are excluded to access good quality images with high resolution. This is a very unpleasant situation and drones could counteract this situation.

"PEOPLES PUBLIC LAB" IN OAXACA

We are inspired by an initiative called the "Public Lab". Do you remember the year 2010? A BP Oil platform explodes in the Gulf of Mexico."Public Lab" was inspired by the information blackout surrounding the disaster in the Gulf of Mexico. Countless volunteer researchers have taken thousands of aerial photographs with balloon drones. This information became known worldwide and

had been for a long time the only public information source about the oil disaster. Out of this initiative was the "Public Lab" founded as a new research and social space for the development of low-cost tools and for community based environmental monitoring and research.

HOW COULD THE PROJECT IN OAXACA DEVELOP?

In Oaxaca we want to build something similar and the drone project shall be part of it and work as an independent GIS laboratory unit. The aim of "Laboratorio público del Pueblo" is to establish a free organization or group, which operates in different directions and with different professional experience backgrounds to apply research on relevant environmental and social communities issues. This group will develop easy to use and affordable environmental technologies and information; with an Internet platform for sharing ideas and data.

Anyone interested in this idea is requested to contact us.

WHO ARE WE? WHAT WE DO?

My name is **Ralph Eichenberger.** I am 55 years old, I lived and worked for 14 years in the Mexican state of Oaxaca. Originally I studied environmental analytical chemistry as laboratory assistant at the Federal Institute of Technology in Zürich (ETH), and continued in the late nineties with the study of environmental expert and ecology at the "sanu future learning" in Biel, Switzerland. In Oaxaca I've been working for 12 years as an independent environmental expert with a focus on Geographic Information Systems (GIS), especially with aerial and satellite imagery for different projects. This are always carried out in close cooperation and participation of the targeted communities and includes social and environmental planning, biodiversity surveys, forest and hydrology management. Besides my experience in GIS, I am in the process of setting up a mobile laboratory for water quality analysis. In addition, I run a mushroom growing experience within the framework of urban agriculture. Currently, I am starting with the use drones as described above. This includes the whole method development and test flights. The aim is to build a group of professionals which are able to collect remote sensing data with low cost drones in almost any locations at any time in Mexico. It goes without saying that we want to network globally, with the aim to exchange data, information, experiences and to work together on projects.

My name is **Gustavo Rodriguez Alcaraz**. I am 38 years old and live in Guadalajara, Jalisco (Mexico).I studied geography at the University of Guadalajara (UDG). At the UNIGIS I took a postgraduate course and have a degree in Geomatics. At age 18, I was a teacher in a rural community in the state of Jalisco. At the age of 20, I was part of a group called "Perseverance", which built a self-sufficient and energetically self-sustaining farm in the town of Tapalpa in Jalisco. I have worked for over 10 years in the field of GIS, remote sensing and image analysis in various projects: Land use and vegetation (INEGI), criminology, forestry and environmental services (CONAFOR). I am currently working for the FAO-UNDP in the area of MRV for the creation of satellite monitoring systems for the

assessment of the carbon emission factors and activity data. When we speak of the calculation of carbon sinks, the idea is to integrate drones in this work. This data could be collected selectively and locally to estimate the potential of carbon sinks.

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ANEXO 1:

ENLACES INFORMATIVOS:

Drone en acción de la selva tropical (Drone in action for the rainforest):
http://www.ethlife.ethz.ch/archive_articles/120227_drohne_per/index_EN
https://www.youtube.com/watch?v=lOm9v0Ewcek&feature=youtu.be

Documental de Al Jazeera y Conservation Drones: La lucha contra la deforestación para proteger a los orangutanes con aviones no tripulados en Indonesia. Al minuto 9:45 comienza una sección muy informativo sobre el uso de aviones no tripulados:
https://www.youtube.com/watch?x-yt-cl=84411374&x-yt
ts=1421828030&feature=player_embedded&v=4sgPwD6Lq1Q

Drones en una misión diferente - New York Times:
http://www.nytimes.com/2014/07/22/science/drones-on-a-different-mission.html?_r=1

Conservationdrones:
http://conservationdrones.org/
https://www.youtube.com/watch?v=yHLSuiEt5Lw
https://www.youtube.com/watch?v=E9n0TRpclw8

Flight Riot:
http://flightriot.com/

Drone Adventure:
http://droneadventures.org/

Public Lab:
http://publiclab.org/

PUBLICACIONES SOBRE EL TEMA:

Small Drones for Community-Based Forest Monitoring: An Assessment of Their Feasibility and Potential in Tropical Areas. Forests 2014, 5, 1481-1507; doi:10.3390/f5061481
http://www.mdpi.com/1999-4907/5/6/1481/pdf

Dawn of drone ecology: low-cost autonomous aerial vehicles for conservation. Tropical Conservation Science, 5(2), 121-132
http://ugallaprimateproject.com/files/Koh_and_Wich-2012.pdf