IES LUCES

ASTURIAS

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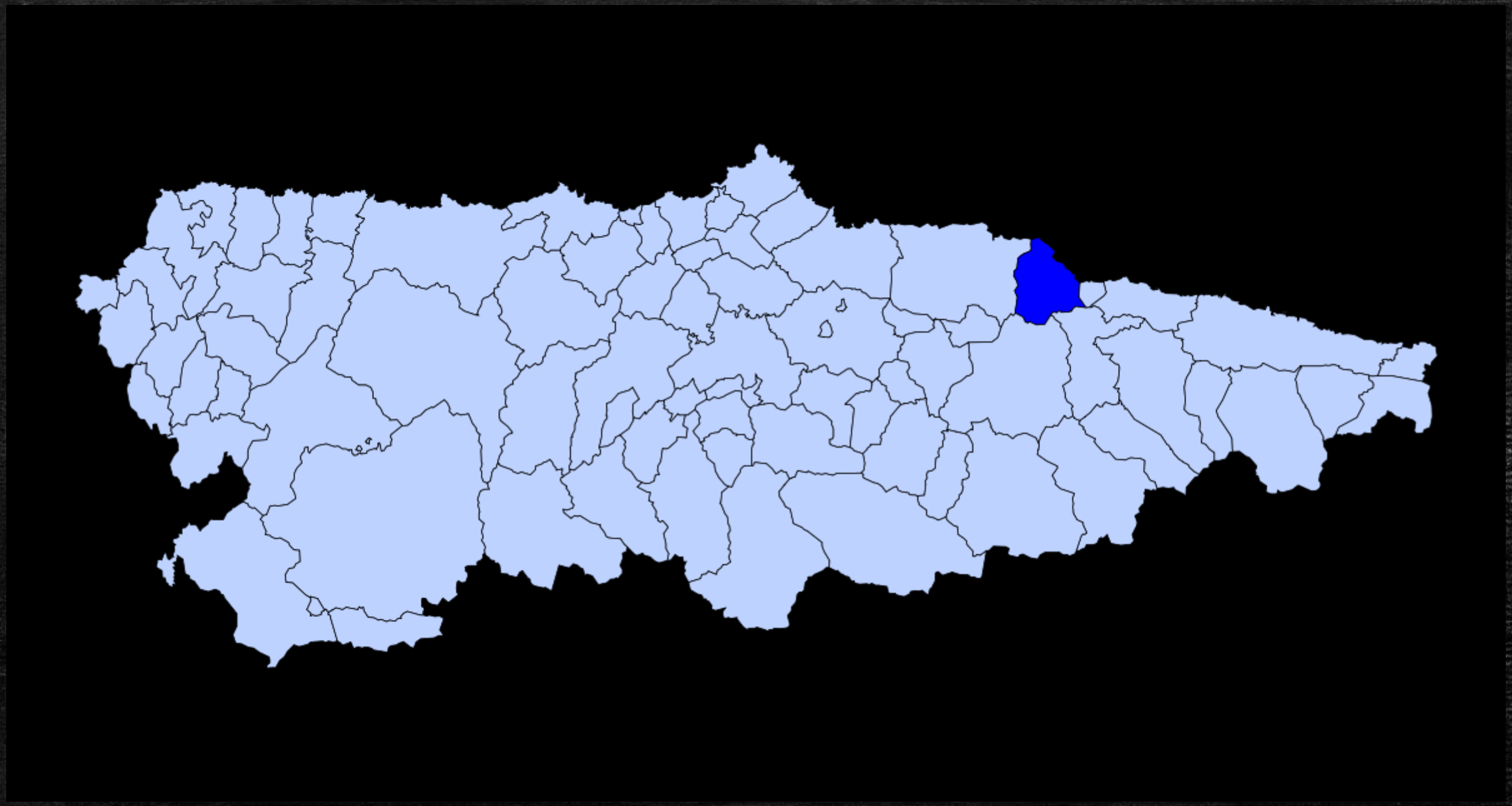
1. Location

Luces. Colunga. Asturias

- The area of Colunga its situated at the Center-east of the Asturias coast. Colunga is a very popular place for tourism due to the bereathtaking landscapes, wild cliffs, smooth rolling mountains, beatiful beachs and picturesque towns as Lastres.
- The central east coast of Asturias is an important places of fossils and footprints of large dinosaurs that inhabited this land for millions of years.
- The Jurassic Museum of Asturias is a unique building designed in the shape of a large dinosaur footprint, houses one of the most comprehensive and concise collection of these factinating reptiles.



Luces. Colunga. Asturias

- The other main attraction of Colunga is the charming fishing town of Lastres, winner of the "Exemplary Town of Asturias Award" in 2010. The center of Lastres has an historic heritage considered of Cultural interest due to its architecture and religious and civic buildings.
- The Council of Colunga is a part of the Route of Santiago, this section is known as the Northen Route which goes along the coast of Asturias.
- The municipality of Colunga is well known for its *sidra* (cider) and *fabes* (beans) production

Lastres

Sidra

Fabes

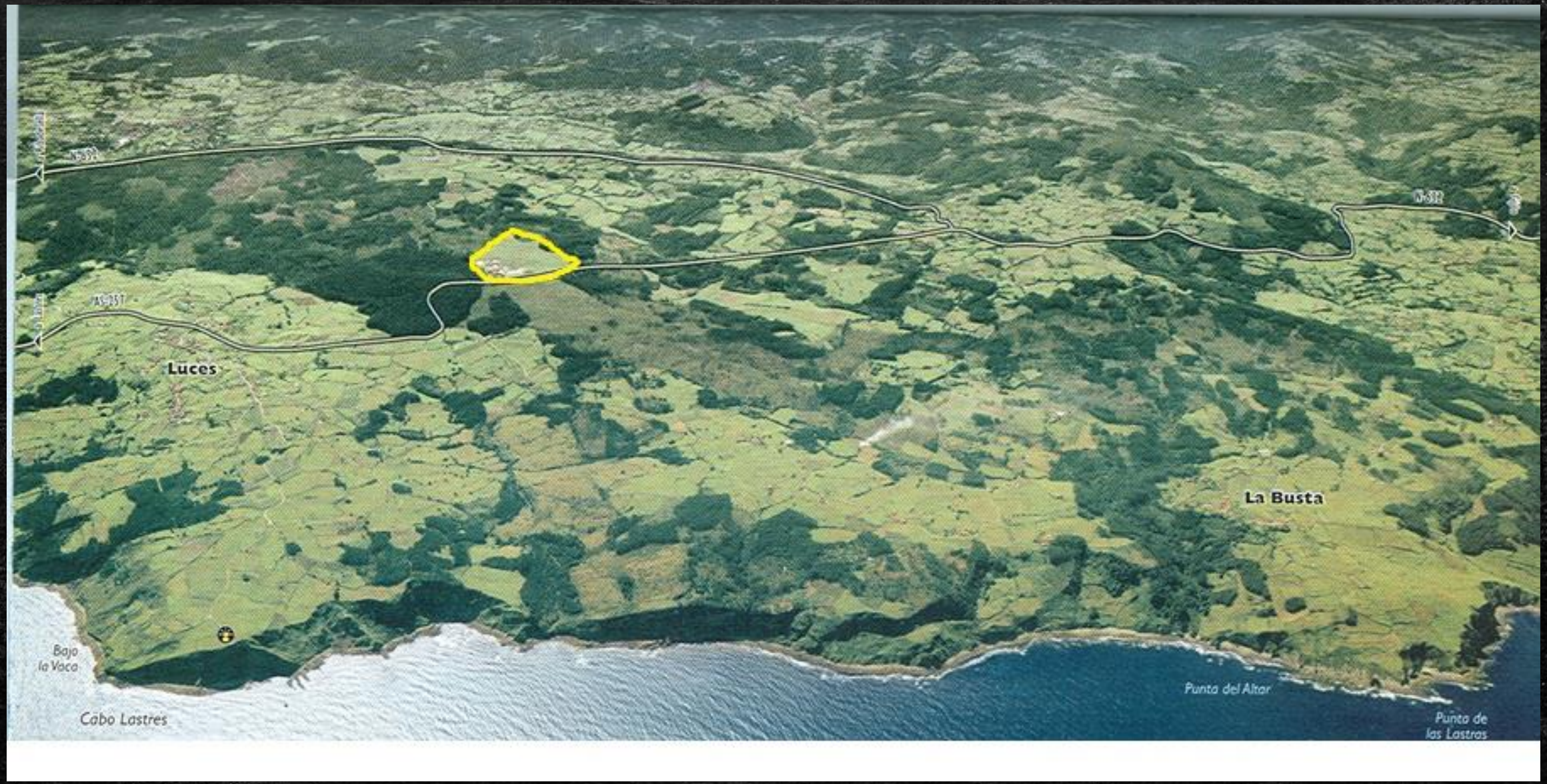
Fish

Luces. Colunga. Asturias

- Its demographic evolution and its economy have been linked, so if its economy was based on five factors: agriculture, livestock, forestry, fishing and tourism.

IES Luces

- Is a working farm with 50 hectáreas divided among 25 fields in the town of Lastres.
- Our farm produces sustainable milk, vegetables, honey, flowers and trees.


AS-257
Luces
La Busta
Bajo
la Vaca
Cabo Lastres
Punta del Altar
Punta de
las Lastras

Luces lighthouse

Main door

Picturesques views

2. School Project

History

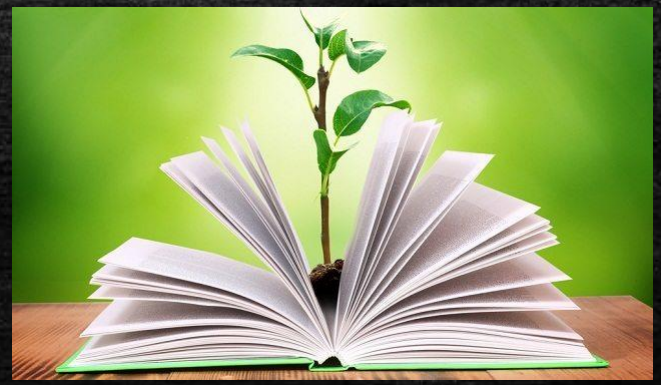
- Begun in the late 1950s as a Farm-School for the training of Asturian farmers.
- In 1977, the center changed its training offer, establishing itself as the Agrarian Professional Training Institute.
- In 1984 the center was transferred to the Ministry of Education and it turned to Secondary School.

Studies

- Compulsory secondary education
- Upper secondary education
  - Bachillerato
- Vocational training
  - Intermediate vocational training
    - Technician in Agro-ecological Production
    - Technician in Gardening and Floristry
  - Higher vocational training
    - Higher Technician in Forest and Natural Environment Management
    - Higher Technician in Livestock and Animal Healthcare

Our philosophy

- **Education for sustainability** develops the knowledge, skills, values and world-views necessary for people to act in ways that contribute to more sustainable patterns of living. … It enables individuals and communities to reflect on ways of interpreting and engaging with the world.
- **TECHNOLOGICAL AND DIDACTIC INNOVATION** in the teaching of Vocational Training



IES Luces sustainable

Techonological and didactic innovation

- Understanding **didactic innovation** as the implementation of processes of deepening and innovation in didactics of interest for the teaching of the different professions, as well as all those processes that involve an improvement of the organization of the center or of relations with companies.
- **And technological innovation, such as that which entails processes of deepening and innovation in techniques and technologies of the different professional families, that includes both the creation of new products or improvement of processes and the resolution of practical and concrete problems arising from the reality of the company.**
- Innovation is a process of change and linked to **entrepreneurship**.
- Inspire determined people to take on the challenge of innovating to set up their own companies in their community

3. Agriculture innovation projects

Cooperate project

- IES luces and the start up NEOALGAE, cooperate in a collaborative project of applied innovation and knowledge transfer in Vocational Training, financed by the Ministry of Education and Vocational Training and co-financed by the European Social Fund within the framework "Operational Program for Employment, Training and Education ESF 2014-2020" .

neo ALGAE
micro seaweed products

Goals

- Circular economy
- Development new skills (students and teachers)
- Incorporating new technologies
- **Encourage creativity, talent and entrepreneurshirp**
- Set up relationships between the school and companies

El proyecto

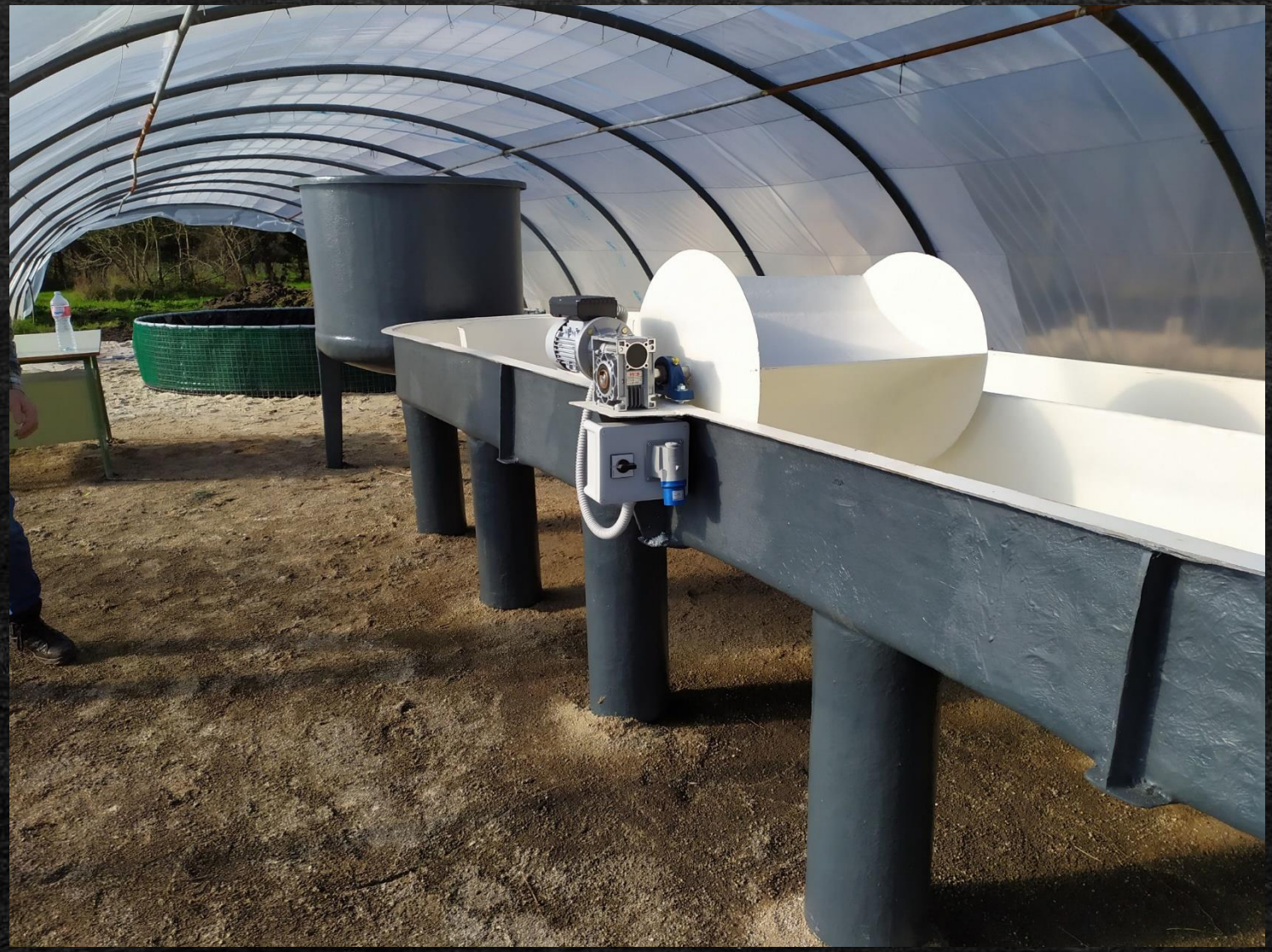
- The project consists of cultivating the spirulina alga (Arthrospira platensis) in photo-bioreactors built for this purpose at the Center and using the slurry from the dairy cattle as a culture medium.
- As a final products:
  - algae which once dried can be used as fertilizer or food for the farm's cattle
  - purified water suitable for irrigation

Facility

- Containers
- Pool (Raceway)
- A greenhouse

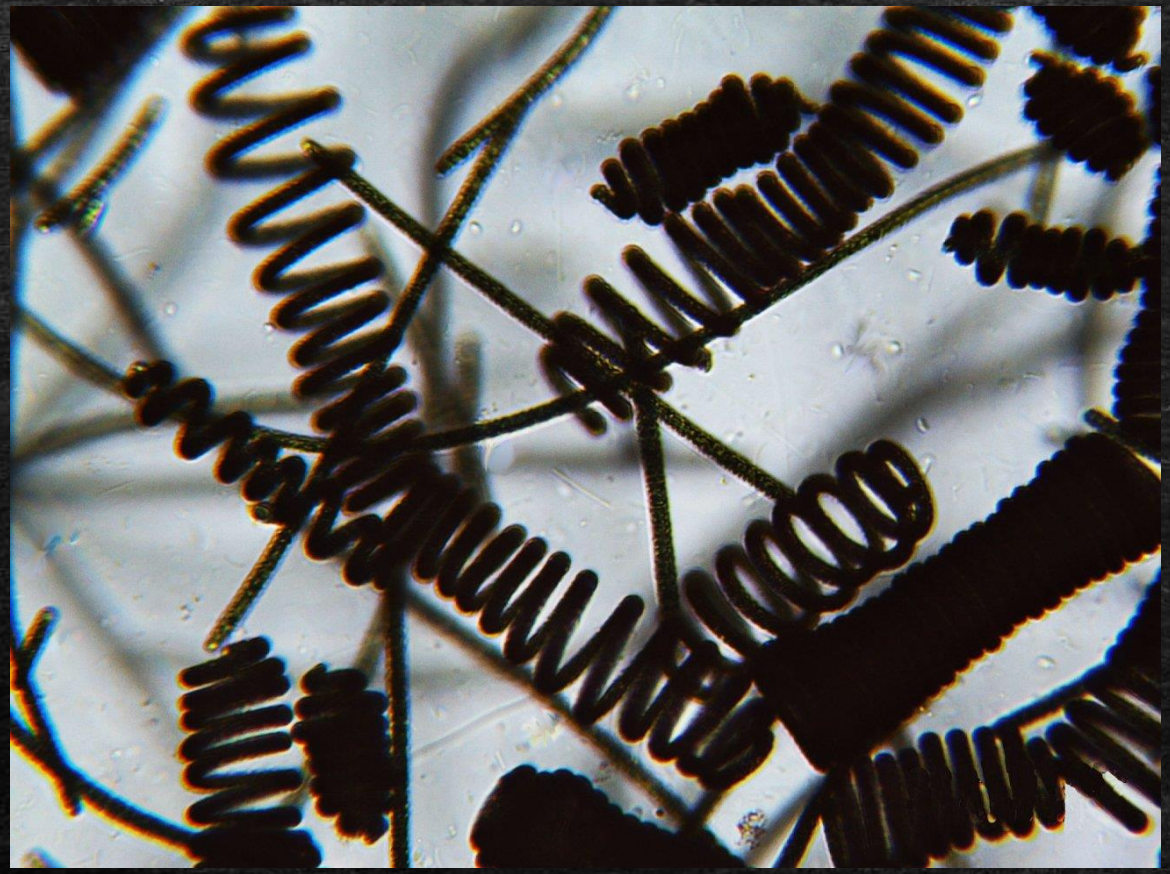
Container

Raceway



Fundamentals of growing spirulina

- In reality, and contrary to popular belief, it is not an algae, but a cyanobacterium, although some official bodies still call it "algae".
- The Latin word *Spirulina* means "*small spiral*" and describes a structure that has this shape.
- Spirulina has a multicellular structure and develops as a plankton in freshwater. Today, it is known that there are more than thirty species of Spirulina.
- *Spirulina platensis* appeared on Earth 3.5 billion years ago and thus became the first organisms capable of photosynthesis.
- This role was fundamental for our planet, since it reduced the so high levels of carbon dioxide, thus promoting an oxygen-rich atmosphere.



Spirulina platensis

Fundamentals of growing spirulina

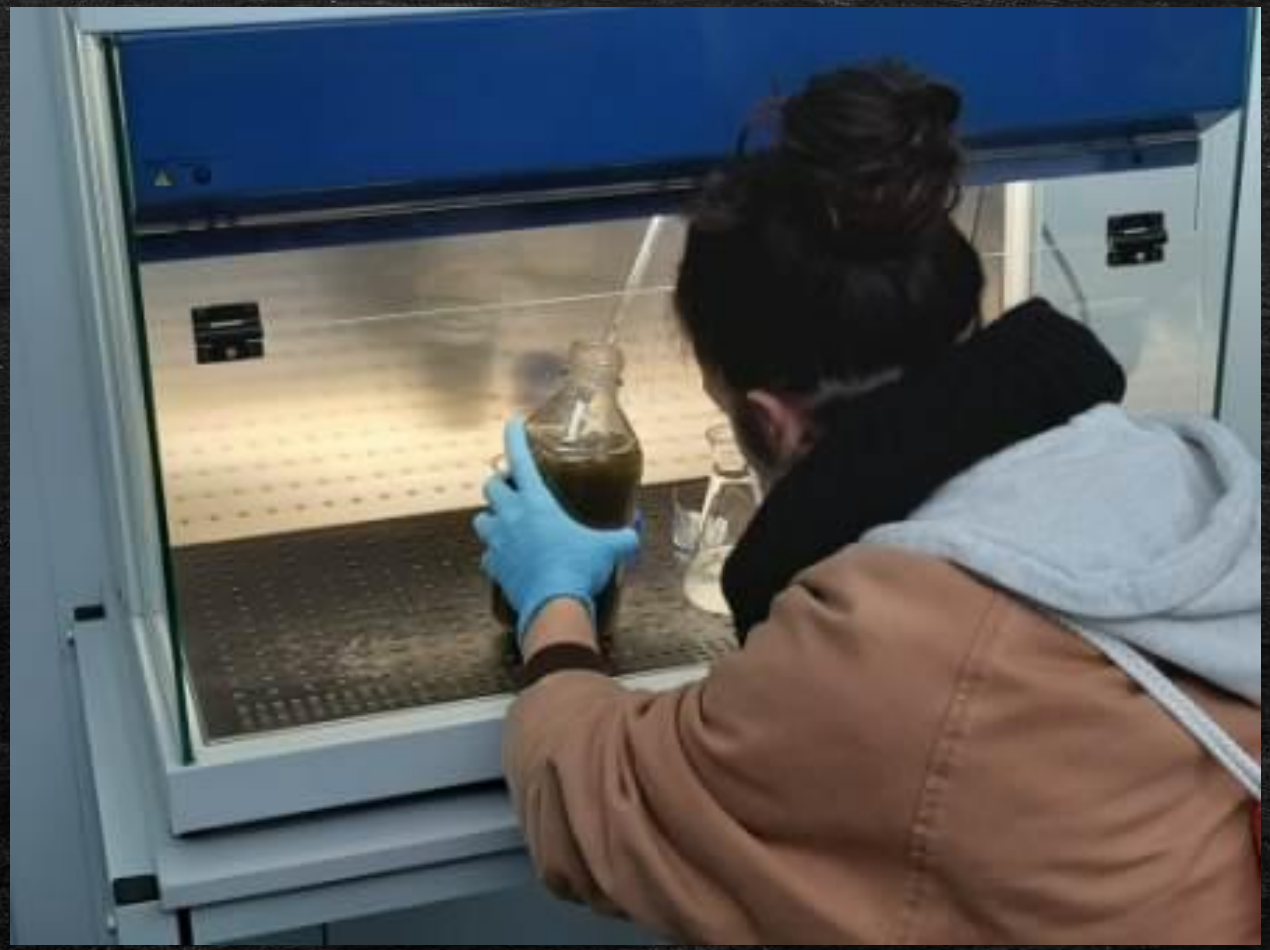
- The first men to consume this seaweed as food were the tribes of Africa settled in the surroundings of Lake Chad.
- Spirulina can be cultivated by man, and in this cultivation there are notable advantages:
  - Its production is very economical
  - Needs *Potassium Nitrate (KNO_3)* that can be substituted with slurry from the cattle farm.
  - That microalgae offer us great potential in nutrition of people and animals
  - We combine the highest technology with maximum respect for the environment.

Spirulina cultivation

- First of all, you have to procure the spirulina mother culture (is the living cyanobacteria needed to start the spirulina production). We acquired our first batch of spirulina from NEOALGAE.
- Spirulina needs sunlight, water, fertilizers and agitation
- We mix spirulina mother culture, fetilizers and water in a tank.
- We should make sure that the container with spirulina gets enough sunshine.
- With proper sunshine, Spirulina will take a minimum of 10 to 15 days to develop.

Spirulina mother culture

Neoalgae ceparium



Student preparing spirulina culture in NEOALGAE's ceparium

Spirulina growing culture

- All Spirulina culture mediums are based on the Zarouk Medium and consist of the following elements: Nitrogen, phosphorus and potassium in large quantities; Sulfur, magnesium and calcium in smaller quantities
- **WEIGH AND MIX FERTILIZERS WITH WATER**
  - The following measurements are for 100 liter water:
    - 1000g Sodium Bicarbonate ($NaHCO_3$)
    - 500g Sodium Chloride ($NaCl$)
    - 10 g Iron Sulfate ($FeSO_4$)
    - 25 liter slurry from the cattle farm
    - 100 liters spirulina

Start Spirulina cultivation (Luces students)

Monitoring

- As in any agriculture crop, it is important to keep track of the status of the Spirulina and of the environment. This close monitoring will enable quality control, early detection of problems and continuous improvement in farming methods.
- The crucial elements that need to be monitored are: temperature (of culture and of air), pH level, culture depth, radiation (amount of light), density.
  - **Temperature** - Optimal temperature for Spirulina is 30-35°C. Spirulina can survive lower (not below 20°C) and slightly higher temperatures (up to 38°C), but it is not advisable as its metabolism will be harmed and it may suffer from a state of 'shock'. Temperatures can be measured with a thermometer.
  - **pH level** – Spirulina can live in a pH level that ranges 8 to 11, but it is at its best at 10.5-11., which is the level that needs to be maintained, as below 10.5 it is at risk of being contaminated and over 11 it undergoes chemical changes.

pH level

Monitoring

- **Density** - Amount of light that passed through the culture gives a good indication to the density of it, indicating if it is ready for harvest (or for increasing its amount) or if density is dangerously low.
- There are several ways to estimate density:
  - Color of the culture - the darker green the culture the denser it is.
  - A second option is looking at a sample from the culture in the microscope - the number of Spirulina filaments and their proximity to one another is a good indication to the culture density.
  - A third option - an X is written on a white sheet of paper. A transparent graduated cylinderis placed over the X. Spirulina culture is poured into the cylinder until the X is no longer visible from the top of the cylinder. The higher the level at which the X is seen the lower the density.

Funcionamiento del espirulímetro

El espirulímetro es lo que se conoce en los laboratorios como *disco de Secchi*. Éste consiste en un escala graduada y al inicio de ésta un fondo blanco. Funciona submergiéndolo en el agua y anotando los cm que ha descendido hasta que se deja de ver el fondo blanco. Los cm que ha descendido indican la turbidez del agua, y en éste caso también indica la concentración de espirulina.

Density

Culture sampling

Daily care of spirulina

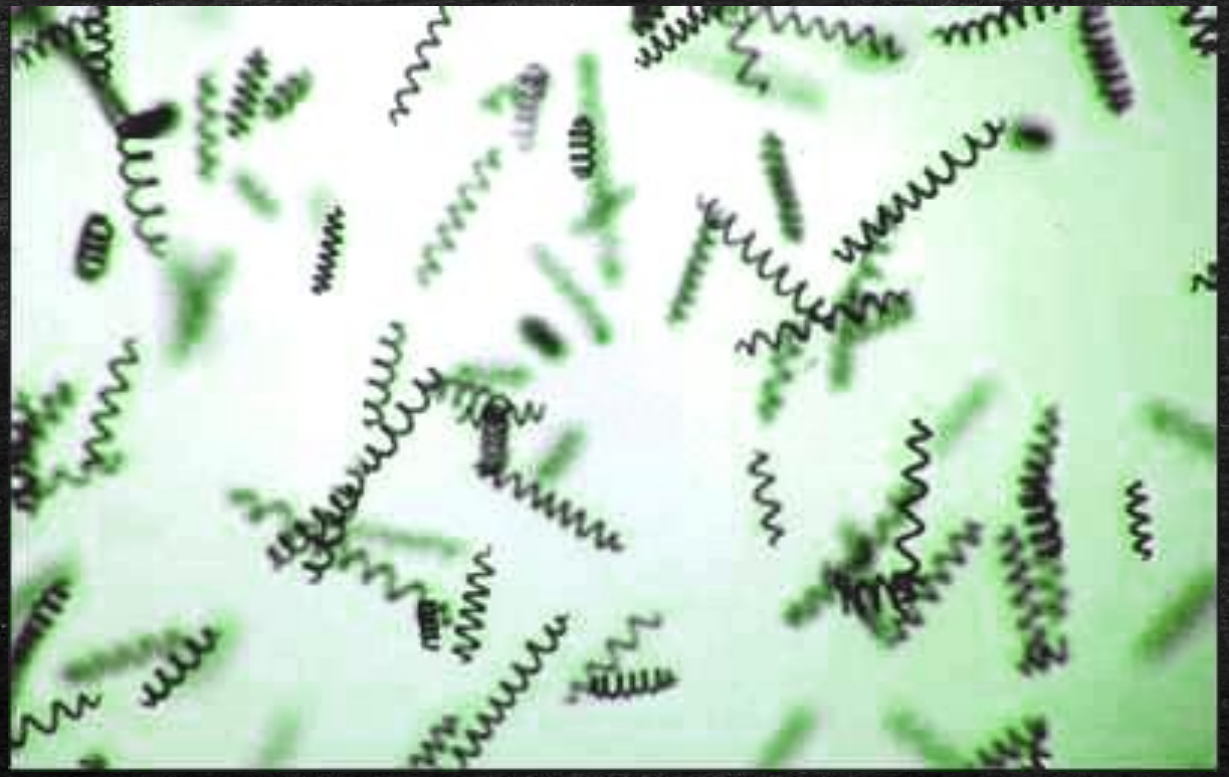


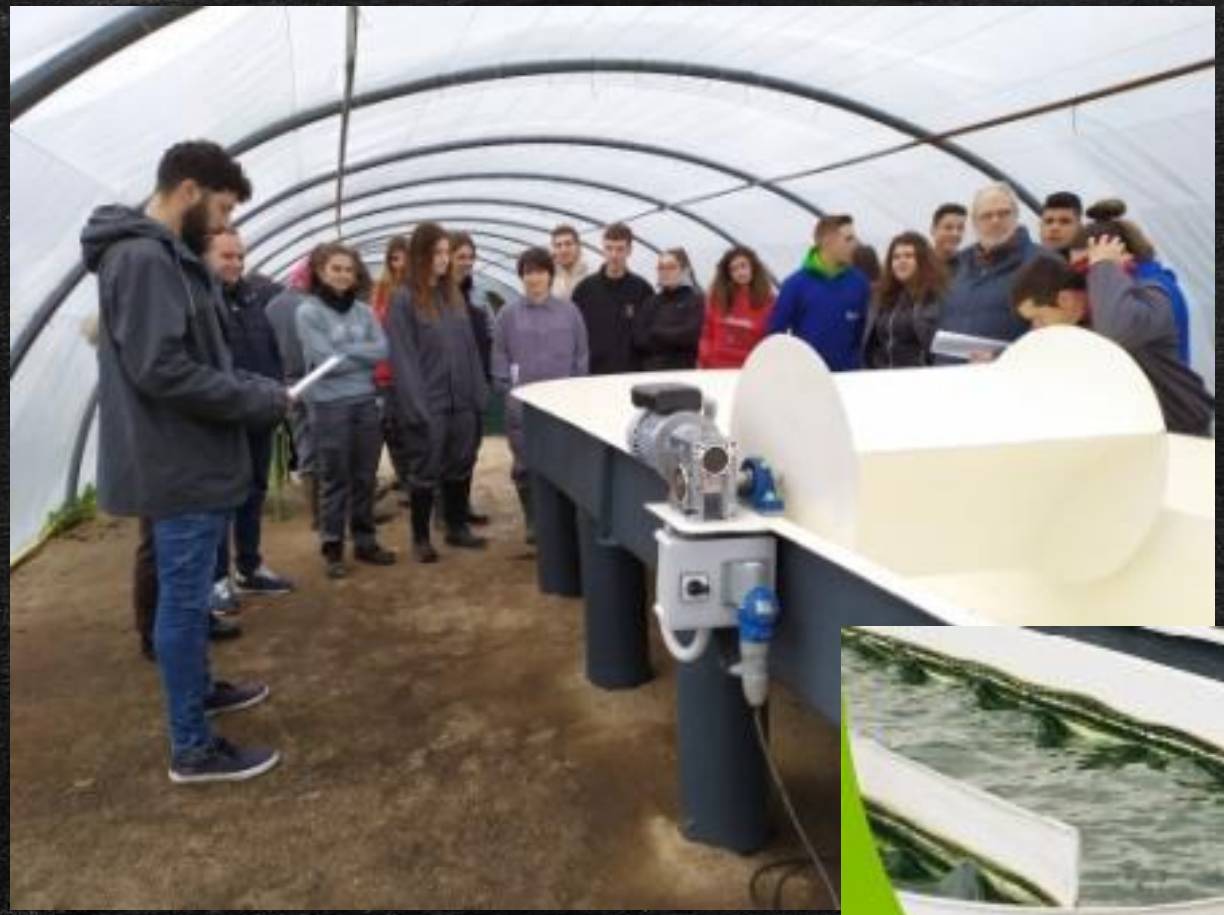
Photo of the spirulina microalgae seen under a microscope. View enlarged x 100. A filament (a spirulina) measures approximately 0.1mm.

Spirulina farming cycles

- Spirulina's reproduction is asexual. Given the right conditions (temperature, lights, fertilizers, agitation) it doubles itself approximately every 48 hours.
- When Spirulina is mature and dense (this can be estimated by the dark green color of the culture, with a microscope or with a graduated cylinder, as will be described in previous section) it is ready for one of two procedures:
  - **Increasing amount of Spirulina**
  - **Harvesting Spirulina**

Increasing the amount of spirulina

- To increase the amount of Spirulina, mature and dense Spirulina is diluted with culture medium (water and fertilizers) in a ratio that is roughly 1:1., thus multiplying the quantity. For example: 100 liters culture medium are added to 100 liters of mature and dense Spirulina. The new quantity of 200 liters will be diluted and thin, but given the proper care and approximately 48 hours it will once again be mature and dense and then ready for yet another multiplication.
- When increasing the quantity of Spirulina, the measurement of the pool or container must be adapted. We finished the process in the raceway



Raceway

Harvesting

- Harvesting spirulina is a delicate process that requires attention, precision and above all, hygiene.
- While there are many ways to harvest and dry the fresh spirulina biomass:
  - Using a nylon filter of 30 microns to separate the biomass of spirulina from the liquid culture.
  - Using a strainer or similar to separate spirulina
- The Spirulina will at this point still have some residue of the culture medium. In order to bring the Spirulina to a pH level that is healthy for consumption (7pH), these residues need to be eliminated. To do so press the filtering cloth (with the Spirulina in it) evenly and gently. The culture medium - which is transparent – will drain from the cloth. When the water draining through the filtering cloth is no longer transparent but green, stop squeezing - this means that all the culture medium has been squeezed out and the Spirulina is at a healthy pH level.

Harvesting using a strainer

Harvesting using nylon filter

Spirulina after filtering

Drying spirulina

- Drying Spirulina is a more efficient and long lasting option. In its dried form it can be kept for many months, as long as it stored in clean and damp free containers.
- Spirulina that is not consumed immediately after harvest can be frozen (in plastic bags or containers) and kept for 2-3 weeks.
- Spread Spirulina on a clean surface and let the sun dry it.

Use of Spirulina

- Can be used for the production of valuable commodities such as animal feeds and agricultural fertilizers, among others.
  - The potential benefits of recycling this algal biomass back to arable soil , on plant growth and nutrition and physical and chemical properties of the soil.
  - Spirulina algae supplementation increases microbial protein production and feed intake and decreases retention time of digesta in the rumen of cattle
- But also, the slurries from the cattle farms that is an environment problem, became a solution. This effluent is used as a nutrient source during cultivation of the microalgae Spirulina, in addition the water use in the microalgae cultivation its recycling and suitable for irrigation.
- In conclusion “circular-economy”.

Students involved in the algae project

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