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Embrapa Agrienergy and Bioinformatics

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The characteristics of the Brazilian Agrienergy Plan - 2006-2011 (PNA) assign Brazilian Agricultural Research Corporation (Embrapa) a leading role because of its comprehensive research network extending over the entire country and its facilities abroad (LABEX), as well as cooperation programs with several developed and developing countries. To achieve the challenges of PNA, in 2006 Embrapa created the Embrapa Agrienergy (CNPAE), as a Research, Development & Innovation (RD&I) thematic unit, whose headquarter is being built in Brasília/DF. It´s construction project addresses thematic, environmental and operational concepts in a building with modern laboratories and pilot plant. The CNPAE´s mission is to 'Enable innovative technological solutions for the sustainable and equitable development of the Agrienergy business in Brazil, in benefit of the society'. It´s vision is 'to be a national leader in generation of knowledge, technology and innovation in Agrienergy'. It's working structure has three dimensions: agronomic, industrial and transversal studies, and four platforms: ethanol, biodiesel, energetic forests and residues. The RD&I is structured in five Thematic Laboratories: Biology of Energy Crops and Microorganisms Lab (including a Bioinformatics Lab), Energy Feedstock Processing Lab (including a Pilot Plant), Co-products and Residues Lab, Agrienergy Knowledge Management Lab, and Chemical and Instrumental Analysis Lab. The Biology of Energy Crops and Microorganisms Lab (LBE) develops basic research in biology for energetic crop improvement and aiming the enhancement of conversion processes. It focuses on the utilization of high-throughput technologies (genomics, transcriptomics, proteomics and metabolomics) for the development of biotechnological tools; development and genetic manipulation of microorganisms and plants of interest to Agrienergy; analysis of biochemical processes of synthesis, degradation and modification of biomass polymers; and characterization of the composition, structure and chemical patterns of different biomasses. One of the research themes of LBE is Bioinformatics, which applies information technology to the solution of biological questions, in our case those relevant to bioenergy. It will involve various analysis such as: assembly, annotation and mining of genomic structures (genes, repetitive elements and regulators, etc.),

metagenomics data analysis, genotyping and phenotyping, selection of molecular markers, construction of biological databases and provision of computational tools. The Bioinformatics Laboratory (LBI) will soon move to a new space (which is under construction) with a work room and a Datacenter. In the Datacenter, currently our rack have three servers with total computational capacity of 12 Quad processors, 2 TB of disk and 384 GB of physical memory; two storages capable of storing over 15 TB of data and a backup robot. The initial efforts of the LBI team are focused in creating the Laboratory facilities, buying and installing the basic equipments, and in starting the analysis of the data already generated for Oil palm (mainly DNA assembly, transcriptomics, SNPs and infrastructure) and Physic nut (infrastructure). The near future challenges includes transposable elements, molecular markers, genome wide selection and microorganisms genomics and transcriptomics. The LBI team work in collaboration with other Bioinformatics teams of Embrapa (CNPTIA) and universities (UNICAMP - LGE), to whom we are grateful. Soon we will announce scholarships opportunities. Sources: (1) Embrapa Agroenergia - Conceitos, estratégia e estrutura de trabalho. Institutional folder. Embrapa; (2) I Plano Diretor da Embrapa Agroenergia: 2008-2011-2023. Brasília, DF:Embrapa Agroenergia, 2008. 43 p; (3) Brazilian Agroenergy Plan 2006-2011. MAPA, Brasília, DF:Embrapa, 2006. 108 p.

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Embrapa Agrienergy oil palm research platform focuses in developing biotechnology and bioinformatics to assist breeding

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Embrapa Agrienergy research efforts focuses in four different platforms related to bioenergy. One is intend to solve the problems related to biodiesel production, and to its widespread use as liquid fuel. The rationale is that, by developing new and efficient ways produce biodiesel and using native and potential oil producing species, the country´s dependency on petroleum diesel will be reduced. The Northern region of Brazil, i.e., depends heavily on diesel to run stationary power generators, river crafts and others. The same region holds some plant species which can produce tons of oil per hectare. Because of that, these species are being seen as potential plant species to meet the requirements of the National Program for Production and Use of Biodiesel, launched by the Federal Government, which links the reduction of petroleum diesel dependency to the regional development. Oil palm (Elaeis guineensis) is the largest

contributor (30%, 48 million t, 2008) at global production of oils and fats stood (soybean oil was second, 23%). What is interesting about this species is that it is not only well adapted to the Northern, but is possess a native relative known as "Caiaué" (Elaeis oleifera), which is resistant/tolerant to bud rot, an abnormality that is decimating entire Oil palm plantations in the southern hemisphere. By intercrossing Oil palm and Caiaué, one can produce a hybrid that closely resemble the Oil palm in terms of oil production, but that retains the tolerance of the Caiaué to this abnormality. In order to assist and improve the Oil palm Breeding Programs (OpBPs) currently conducted by Embrapa´s units, as well as seeds offer and the national production of Oil palm, Embrapa Agrienergy leads several RD&I projects which aims the development of biotechnological and bioformatics tools. Among these projects the main ones are Prodendê, Bioelaeis, Fenomics, OPGP and Dendepalm. The Prodendê project goals include: to assist cultivars development through conventional and biotechnological methods; to develop a reference system for genetic transformation; and to build an Caiaué ESTs´ database. The Bioelaeis project main goal is to develop and multiply interspecific hybrids, incorporating specific traits of interest from Caiaué into the commercial genotypes, i.e. tolerance and/or resistance to bud rot, reduced vertical growth and high oil productivity, by means of in vitro multiplication, assisted selection and plant transformation. The Fenomics project main goal is to characterize genetic resources (plants and microorganisms) through the use of high precision phenotyping and reverse genetics, including photosynthetic efficiency and abiotic stress analysis. Embrapa Agrienergy also participates in the OPGP, an international consortium that aims to obtain the genome sequencing of Elaeis guineensis and a transcriptome of both E. guineensis and E. oleifera. Finally, it is under final phase of evaluation the Dendepalm project, with the main goal of enabling in the medium-term RD&I of Sustainable production of Oil palm at Embrapa and SNPA (National System of Agricultural Research). It includes Oil palm germplasm and microbiota characterization (phenomics, genomics), in vitro multiplication process, and a draft of E. oleifera genome.Since all these projects are going to generate huge amounts of data - from phenotypes of the plants that compose the germplasm banks, to high-throughput sequencing reads - bioinformatics is undoubtedly a key field, to help transform raw data into applied knowledge and technologies. The Embrapa Agrienergy´s Bioinformatics Lab aims to do this transformation, working together with partners and through bioinformatics analysis, in construction and maintenance of databases, development and availability of tools and providing technical support to Oil palm RD&I. Supported by: Embrapa Agrienergy