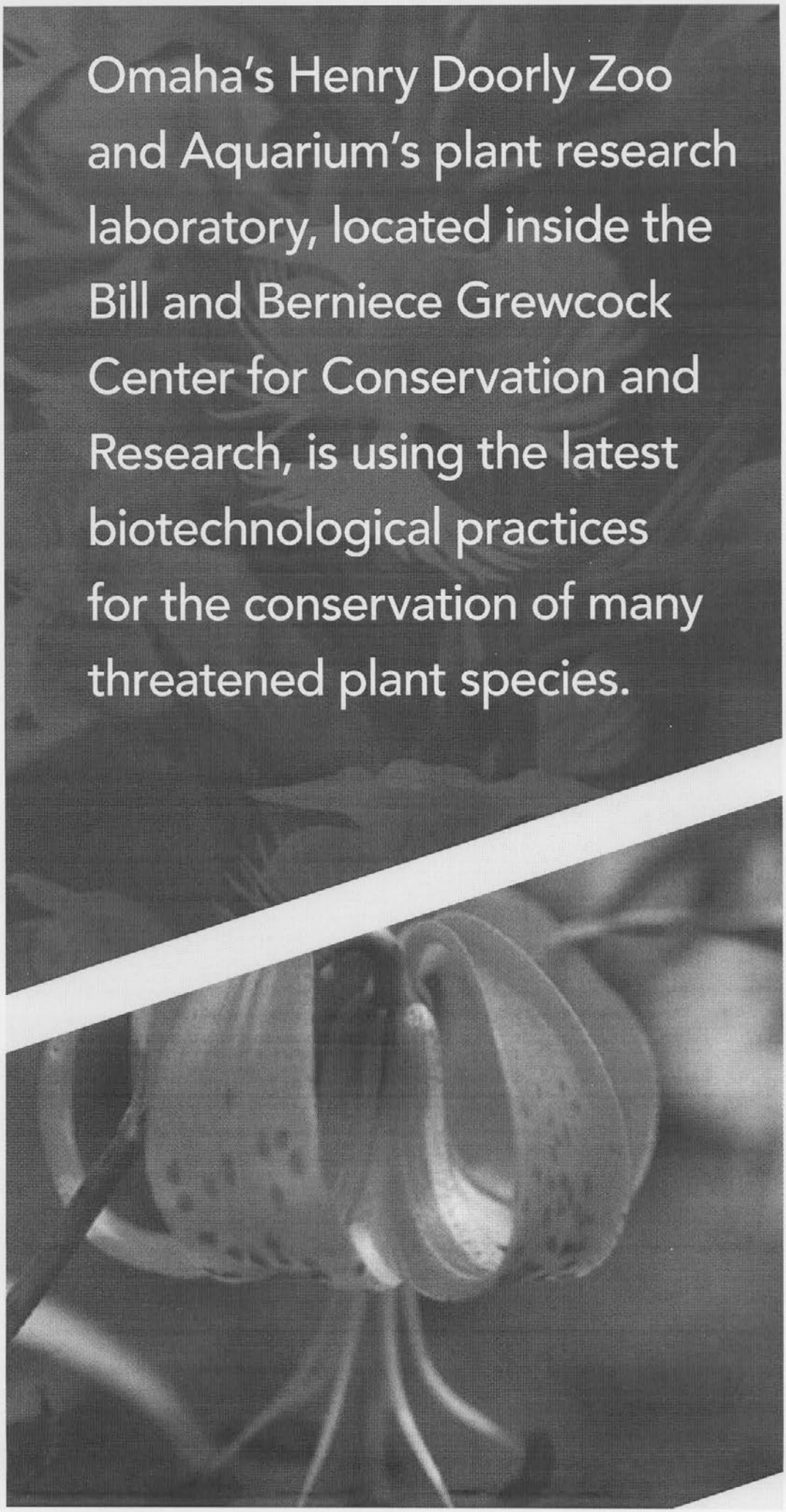
Omaha's Henry Doorly Zoo and Aquarium's plant research laboratory, located inside the Bill and Berniece Grewcock Center for Conservation and Research, is using the latest biotechnological practices for the conservation of many threatened plant species.

OK

Saving Biodiversity through Plant Biotechnology

Margaret M. From, ~~M. Sc.~~ M.S., Director of Plant Conservation

All plant species that exist on Earth today are interdependent. Plants provide the basis for all other life forms. Consequently, any positive ~~or~~ negative impact on a single species ~~can~~ may carry ramifications throughout the ecosystem.

When a plant goes extinct, it takes with it approximately 10 to 30 non-plant species. Sometimes, many more. Those non-plant species can include animals, insects and microbes that form the biodiversity we value in our world. Plants provide us food, fiber, timber, fresh air, clean water, soil mass and almost half of all of our medicine supply.

Only about two to three percent of the 250,000 currently known plant species have ever been investigated for their medicinal value, according to Botanic Gardens Conservation International. And, many plant species are going extinct before we can ever begin to understand their benefits to other life forms.

Today, botanists throughout the world search the plant kingdom for new medicines, even in the wild places still to be found in the United States.

Omaha's Henry Doorly Zoo and Aquarium's Department of Plant Conservation research laboratory conducts research and reintroduction of about 200 threatened plant species in the following countries: the United States, Madagascar, Bermuda, China and Costa Rica. The Zoo's plant laboratory was recently awarded a three-year grant to cryopreserve seeds and spores ~~for~~ plants ~~from~~ South African threatened habitats.

Several species researched at the Zoo's laboratory have been saved from extinction through the intervention of the Zoo's lab personnel and their collaborators from each species' country of origin. The species studied and reintroduced to the wild include lilies, orchids, ferns, aloes and carnivorous plants—to name a few.

Biotechnological methods allow the lab to produce many plants in vitro from small samples of seeds and the resulting plants are subsequently used for reintroduction in

their native habitats. Omaha's Henry Doorly Zoo and Aquarium's plant scientists collect small samples of seeds to ensure there won't be any negative impact on wild plant populations.

Sterile in-vitro culture practices mean that the laboratory is able to propagate much larger numbers of plants from the seeds collected than what ~~is able to~~ would survive to adult size in the wild, if the same number of seeds were to naturally disperse in their native habitat.

Reintroductions are made in the same area where the seeds were collected with the goal of augmenting wild populations so that sustainable populations will continue to exist in the country of origin.

Thousands of young plants have been reintroduced from Omaha's Henry Doorly Zoo and Aquarium's laboratory to Madagascar, Bermuda, Nebraska and Minnesota with some ~~being~~ having been sent back as far as China. Collaborative reintroductions have been made with the Madagascar Forestry Department, Bermuda's Ministry of the Environment, the Audubon Society, The Nature Conservancy, the U.S. Fish and Wildlife Service, as well as several other state, local and regional conservation organizations.

Small numbers of the species researched are also kept at the Zoo for future study and education purposes. In addition, Omaha's Henry Doorly Zoo and Aquarium's plant laboratory has also created a frozen seed bank as a backup plan for species recovery well into the future.

By storing the seeds in liquid nitrogen at -197 degrees Celcius, the seeds will remain in a slowed metabolic state where they can remain viable for years and later be thawed, cultured and used for additional research and introductions. Zoos everywhere are now being called upon to contribute to the preservation of habitats where the animals they care for originate. Plants create those habitats. Once a species is extinct, it's gone forever. And through plant reintroductions, zoos are able to support their conservation mission for generations to come.

Encroachment in Belize

Dr. Julie Napier, Senior Veterinarian

Burgeoning human populations and controlled forest fires to increase ~~the size of~~ farmland are the main reasons ~~as to~~ why the habitats of many endangered species are being encroached upon, especially in Central America.

Belize, located between Mexico and Guatemala, is a country rich in natural resources and diverse wildlife, including many species found at Omaha's Henry Doorly Zoo and Aquarium and Wildlife Safari Park.

Exotic cats, including jaguar, puma, ocelot, as well as smaller cats like margay and jaguarundi ~~inhabiting~~ the country have constant ~~interface~~ with natives and domestic animals.

In May 2013, a team of veterinarians from Omaha's Henry Doorly Zoo and Aquarium ~~in Omaha, Nebraska~~; Rolling Hills Zoo in Salina, Kansas; and Zoo Miami in Miami, Florida, initiated a project at the Lamanai Field Research Center in the Orange Walk District of Belize ~~to~~ provide veterinary expertise and support to a group of primary researchers studying these felid populations in the areas surrounding the Indian Church and San Carlos ~~villages.~~

Zoo veterinarians conducted designated capture periods to safely and effectively immobilize any exotic cat or bycatch species for the study, all in an effort to better understand each species' health and behavior.

Free animal health clinics with physical examinations and parasite treatments were also organized to provide health care to villagers' dogs and cats and to obtain blood samples for future comparative serological studies ~~to~~ on wild felids for disease assessment. The trip resulted ~~with~~ in the creation of an on-site lab~~oratory~~ facility capable of processing and storing blood samples, ~~in addition to undergoing viral testing~~. including the performance of viral tests.

With equipment donations from the three zoos involved in this project, researchers in Belize now have a fully operational hub~~spot to help~~ for determining the relative health of wild cat populations.

Omaha's Henry Doorly Zoo and Aquarium hopes to continue its efforts with these wild cat populations, as well as establish more research projects in Belize with the many other indigenous species, such as howler monkeys and tapirs.

Biobanking for Research

Dr. Naida Loskutoff,
Director of Reproductive Sciences

Developing effective methodologies for banking biomaterials—such as gametes and tissues—is becoming an increasingly important tool for research in conservation sciences, particularly ~~in~~ veterinary ~~medical fields,~~ reproductive technologies, molecular genetics, comparative nutrition and rare plant conservation.

Reason being: With dwindling populations of wildlife in nature, research can be conducted on banked tissues ~~that can eventually lead~~ to increasing our knowledge ~~of~~ how to more effectively manage wildlife and prevent any further loss of genetic diversity.

Omaha's Henry Doorly Zoo and Aquarium's Reproductive Sciences Department has been actively involved in several programs

to develop successful biobanking programs in several countries.

In October 2012, I was invited to give a week-long course on reproductive technology and crybanking genetic diversity at the Brazilian Association of Wildlife Veterinarians in Florianópolis, Santa Catarina, in Brazil.

Following my time there, I was appointed as a research associate and curator of the biobank of the National Zoological Gardens of South Africa in Pretoria. My staff—Jonathan Aaltonen, laboratory supervisor, and William Synder, research assistant—and I have been training the zoological gardens' technical staff and interns on proper tissue culturing techniques and in-vitro embryo production, as well as sperm and embryo cryopreservation or freezing for long-term storage.

continued on page 8

Conservation Firsts

Most projects at Omaha's Henry Doorly Zoo and Aquarium are collaborations with other zoos' research programs or veterinary specialists. Some of our most notable ones have required the use of in-vitro fertilization, resulting in some conservation firsts across zoos and aquariums worldwide.

First infant gorilla produced by in-vitro fertilization, in collaboration with the Cinncinati Zoo

First tiger cubs produced by in-vitro fertilization, in collaboration with the National Zoological Park

First gaur calf produced by in-vitro fertilization, in collaboration with TransOva Genetics in Sioux Center, Iowa

two words

Biobanking *continued from page 7*

Assisted reproductive technology will not replace natural breeding long-term, but it can aid in wildlife conservation. This is so because gametes—sperm and oocytes, or eggs—can be recovered from animals even after their death to produce embryos and, after transferring into suitable recipient animals, or surrogates, result in offspring.

In January 2013, Omaha's Henry Doorly Zoo and Aquarium welcomed a new doctorate student, Colleen Lambo, DVM. Under my supervision ~~through~~ via her appointment as graduate faculty in the Department of Obstetrics and Gynecology at the University of Nebraska Medical Center, Dr. Lambo will work on a dissertation project ~~that will~~ to help further the success of assisted reproductive procedures, such as artificial insemination and embryo transfers, in felids—particularly tigers, all of which are threatened or endangered.

~~Several levels of~~ students at several grade levels are regularly welcomed into Omaha's Henry Doorly Zoo and Aquarium's program with the hope of someday encouraging students to pursue

careers in conservation sciences, beginning at the high school level.

Each year, as a way to keep ~~the~~ this's interest alive, I deliver keynote addresses throughout Nebraska, such as the Expanding Your Horizons and the Science, Technology, Engineering and Math programs to encourage seventh- to ninth-grade girls to continue their studies in these fields at their respective colleges and universities ~~in these fields~~.

Is "Expanding Your Horizons" a separate keynote and S,T,E, and M another?

Seems self-contradictory. Seventh to ninth-grade but in college?

Seems garbled. Not sure what's what here. Ask for rewrite/ clarifications.

Field Notes *continued from page 5*

The International Prosimian Congress attendees were impressed with the comprehensive conservation work based

at the field station, which includes lemur monitoring, an expansive community-based reforestation initiative and the introduction of green technologies. Surprisingly, I was honored at the International Prosimian Congress meeting with a distinguished professor award for my commitment to supporting and training Malagasy graduate students, who are an integral part of all ~~of~~ our endeavors. Over the years, Omaha's Henry Doorly Zoo and Aquarium's conservation genetics program has helped more than 45 graduate students complete their master's and doctorate degrees.

Out of all ~~of~~ the work ~~that~~ the Zoo supports, our reforestation program in Kianjavato inspires me the most. With the help of local participants, we have planted more than 100,000 trees in the region in the past two years, making the future brighter, and hopefully greener, for these communities and the lemurs. As of October, I'm back in Madagascar and look forward to sharing more stories of hope and progress.

OMAHA'S HENRY DOORLY ZOO & AQUARIUM

Omaha Zoological Society
Omaha's Henry Doorly Zoo and Aquarium
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