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"SILK ROAD CAMEL: THE CAMELIDS, MAIN STAKES FOR SUSTAINABLE DEVELOPMENT"

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CAMELIDS AND SUSTAINABLE DEVELOPMENT

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Abstract

Face to the global changes and new climatic constraints, the camel farming is confronted to new challenges, first to contribute to the "livestock revolution" (for reaching the requirements of a growing human population), especially in remote places of arid and mountainous areas, and in the same time to satisfy the necessity of sustainable development for the future generation. The current trends of the camelid farming systems in the world (settlement, intensification, market integration, territorial expanding, emerging diseases) question the scientists and the developers on the right ways for a sustainable development. Several aspects are discussed in the present paper: (i) the assessment of the contribution of camelids in the greenhouse gas emission, in relationships with the camel demography, (ii) the assessment and preservation of the camelid biodiversity, (ii) the assessment of the changes in the animal metabolism and in the environment management face to the intensification process, (iv) the control of the transboundary diseases in a population marked by mobility, and (v) the future of the social role of camelid in the more and more urbanized world.

Keywords: camel, sustainable development, farming system, biodiversity, demography, market, resources management

ТҮЙЕЛЕР ЖӘНЕ ТҰРАҚТЫ ДАМУ

Ғалымдық өзгерулер мен жаңа климаттық шектеулер алдында түйе шаруашылықтары жаңа мәселелерге тап болды, ол біріншіден «ауылшаруашылық революциясы» (өсіп келе жатқан халық санын қамтамасыз ету), атап айтқанда алыстанған шөл және таулы аймақтар, және болашақ ұрпақ үшін тұрақты дамуды қамтамасыз ету. Ғалымдар мен дамытушылар дүние жүзіндегі түйе шаруашылық жүйесінің қазіргі кездегі тенденцияларын дамытудың дұрыс жолдарын талқылауда (қоныс орындары, интенсификация, нарықтық интеграция, территорияның кеңеюі, жаңа аурулар). Оның бірнеше аспектілері осы жұмыста талқыланады: (i) демографияны еске ала отырып, түйелердің парниктік газдарға қосатын үлесі, (ii) түйелердің биоәртүрлілігін сынау және қорғау, (iii) интенсификация үрдісіндегі жануар метаболизмінің өзгеруін және қоршаған ортаны басқаруын сынау, (iv) белгіленген халық мобильдігі шартында трансшекаралық ауруларды басқару, және (v) күннен күнге урбанизацияланып келе жатқан дүние жүзіндегі түйенің әлеуметтік ролінің болашағы.

Түйін сөздер: түйе, тұрақты даму, ауыл шаруашылық жүйесі, биоәртүрлілік, демография, нарық, ресурстарды басқару.

ВЕРБЛЮДЫ И УСТОЙЧИВОЕ РАЗВИТИЕ

Ввиду глобальных изменений и новых климатических условий верблюжьи хозяйства столкнулись с новыми проблемами. Это в первую очередь так называемая «сельскохозяйственная революция», направленная на удовлетворение требований растущего населения, особенно в отдаленных пустынных и горных районах, и в то же время призванная удовлетворить потребности устойчивого развития для будущих поколений. Учеными и исследователями обсуждаются принципиальные пути развития систем верблюжьих хозяйств в мире (устройство, интенсификация, рыночная интеграция, территориальное расширение, новые болезни). В данной работе обсуждаются несколько аспектов: (i) оценка вклада верблюдов в выброс парниковых газов с учетом демографии, (ii) оценка и защита биоразнообразия верблюдов, (iii) оценка изменений в метаболизме животных и в управлении окружающей средой в процессе интенсификации, (iv) контроль за трансграничными заболеваниями в отмеченной мобильности населения и (v) будущее социальной роли верблюдов в урбанистическом мире.

Ключевые слова: верблюд, устойчивое развитие, система земледелия, биоразнообразие, демография, рынок, управление ресурсами.

Introduction

It is pretty funny to see that most of the scientific papers start by a phrase such as "the camel is well adapted to harsh conditions". Of course, large and small camelids are inextricably linked to the desert and Andean mountains ecosystem respectively. Large camelids for example are, among the domestic animals, the most adapted to the desert environment parameters: drought, differential temperatures between day and night, poor and scattered feed resources. However nowadays, the image of camel cannot be limited to the legendary caravans along some "silk road", crossing the vast desert spaces of the old world, or to be the runner in the dunes for the pleasure of a few wealthy emirs. Important changes occur in the camelid farming systems around the world (Faye et al., 2012; Faye, 2013) and these changes have obviously significant impacts on the animal itself and on the scientific questions raised to the community of "camelologists". And one of the main question is regarding the balance between development of the camelid farming systems and their sustainability in this new context where the traditional form of camel rearing (extensive farming, low input, high mobility, living in remote places,…) is submitted to significant and rapid changes. The concept of "sustainability" was defined by the United Nations as the development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Adams, 2006). The question of the "sustainable development" for camelid farming systems cannot be

ignored by the scientific community, too often hidden behind a simple search of technical innovation. The commitment into sustainable development implies responsible and proactive decision-making and innovation that minimizes negative impact and maintains balance between social, environmental, and economic growth to ensure a desirable planet for all species now and in the future.

In that context, the camelids, the most important animals domesticated by the mankind in the desert or Andean ecosystem, are faced to important challenges because they are directly confronted to one of the hot-spot regarding the interaction livestock/environment (Steinfeld et al*.,* 1999), i.e. the desertification process. Everyone agrees that camelids are environmentally friendship animal and that camelid farming systems have a low environmental pressure activity (Raziq et al., 2008). However, how the current changes in the camel farming systems could modify the traditional relationships between the camel and their environment? In the present communication, the sustainability will be approached through five items (i) the assessment of the contribution of camelids in the greenhouse gas emission, in relationships with the camel demography, (ii) the assessment and preservation of the camelid biodiversity, (iii) the assessment of the changes in the animal metabolism and in the environment management face to the intensification process, (iv) the control of the transboundary diseases in a population marked by mobility, and (v) the future of the social role of camelid in the more and more urbanized world.

The changes in camel farming systems: the driving forces

Traditional camelid farming systems are extensive based on the use of natural resources, low inputs and herd mobility. Yet, apparently submitted to low pressure all along the XXth century, except during the droughts that hit parts of the world, those systems change under the pressure of 3 main driving forces: (i) the accentuation of the environmental aridity linked to the climatic changes, (ii) the globalization of the world economy pushing the camelid farming to be more integrated into the market, (iii) the change in the territorial distribution marked by an expansion of the traditional farming area and by an increasing risk of emerging diseases (Faye et al., 2012).

- The growing aridity

Many part of the arid lands of the new and old world are marked for a century by drought periods causing the advance of desertification and degradation of the vegetation (Nicholson, 2001). For example, since year 1900, Sahara has extended by 250 km to the regularly south and along a 6000 km front (Leroux, 2004). The rainfall deficit has been increasing since the 1970s (figure 3) although an increase in the water flow has been observed and linked to less frequent but more abundant rainfall (Little et al. 2001). In the same time, the analysis of the maximum temperatures in arid lands of Africa shows that the tendency is with the rise. The observable impacts of this climatic change on the livestock are the increase risks on the nutritive value of available feed resources and on biomass availability, the increased risks of conflicts between pastoralists and farmers, the developing trends of mixed crop-livestock systems and the increased epidemiological risks (Thornton et al., 2009). In such context, the camel appears among the less sensitive animal. However, camel farming has undergone changes such as the expansion of the geographical distribution of the species, the use of the camel with its higher integration in mixed crop-livestock systems, and the increased risk to emerging diseases.

- The growing market integration

Camelids are known as multi-purpose animals, providing the larger services to the human: milk, meat, wool, leather, manure, draught and other agricultural services, packing, riding and leisure including racing and beauty contests. Yet, except for camel meat integrated in regional market between the Horn of Africa and Arabian Peninsula, of for alpaca wool integrated in international textile market, the contribution of the camel products in the global economy is still marginal. It is noticeable that in spite of the high interest of consumers for camel milk, in a country like Saudi Arabia, 38% of the produced milk only, reach the market (organized or not), the remaining being self-consumed or distributed to the relatives (Faye et al., 2014). However, in many countries, the emergence of small or large camel dairy plants as well as the milk processing increase leading to significant change in the added value chains (Faye and Konuspayeva, 2012).

- The territorial expansion of the camelids

The small camelids are invading many western countries were they are regarded as pet animals (Giudicelli and Giudicelli, 2013). Regarding camel, recent trends show the territorial expansion of the camel distribution, mainly in Africa, both at latitude level (migration of the camel population to the southern parts of the Sahelian countries) or altitude level (notably in Ethiopia). This expansion could reach countries where no camel tradition occurs like in Tanzania (Wilson, 2013) or be adopted by traditional cattle breeders like Massaï or Peul (Cecchi et al., 2010). Thus, this expansion is not only related to human expansion (occupation of new spaces by camel breeders with a tendency to convert to agricultural activities), but also to the expansion of the species into cattle farming systems. The camel consequently tends to occupy spaces where the groups of settled agro-pastoralists are predominant. These farmers adopt camels for agricultural activities and consequently, the camels contribute to the intensification process of the farming systems associated to the settlement of the farmers. In spite of a weak numerical productivity due to a slow reproductive cycle, the high variability of the performances observed between animals leads to possible productivity progress. This potential is used to intensify the camel productivity through intensified systems (Breulmann et al., 2007).

Camel demography and greenhouse gas emission

A recent controversy occurs after the declaration of the Australian government regarding the destruction of the wild camel population in order to decrease the percentage of greenhouse gas emission by the country and consequently “for saving the planet” as mentioned in some newspapers. It is true that camel overpopulation could generate environmental problems and that requires proper management, but targeting camels and considering them as a major contributor to methane emission among other herbivores in Australia is quite debatable. At the world level with less than 28 million heads (FAOstat, 2014), the camel population is representing less than 1% of the total herbivorous biomass. Elsewhere, camel population is living in extensive arid lands where the carbon and methane emission is among the lowest at the surface of the earth. Moreover, recent publications confirm that the dromedary camel, Bactrian camel, lama and vicuna emit less methane than the other ruminants. The camels produce 0.32l/kg LW/day methane *vs* 0.58l/kg on average for cattle and sheep (Dittman et al., 2014) due to the lower fiber intake of the camelids. Finally, in Australia, the contribution of the camels to the methane emission is less than 2%. At the world level, the contribution of camelids (small and large) in the emission of methane is approximately 1% *vs* 72% for cattle (figure 1). The camelids represent only 0.92% of the animal population of ruminants and domestic pseudo-ruminants while cattle account for 38% (Faye and Bonnet, 2012).

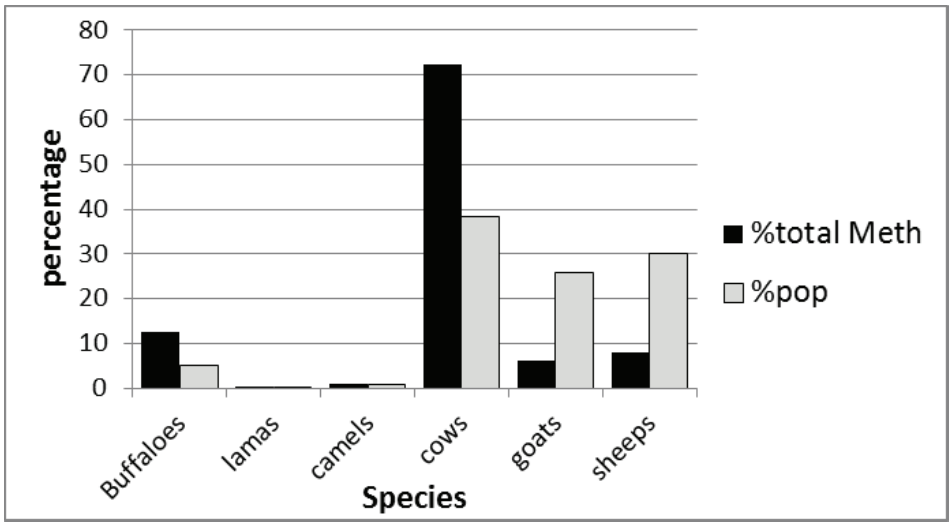

Figure 1. Contribution of the different ruminant species (in %) to the methane emission and their relative population at world level

In the same way, it has been demonstrated that on average, the emission of ammonia in a stable of adult camels is estimated at 5-6 kg of ammonia/head/year, corresponding to about 50% of what makes a dairy cow. Moreover, if manure management is included in the calculation ammonia emissions are not more than 1.5-2.0 kg/animal/year i.e., 10 to 20% only of what produces a cow (Smits and Montety, 2009).

However, the "ecological footprint" of the camelids has to be assessed also by their environmental carrying capacity, i.e. the ratio between the whole population and the available resources (water, feeding, land) for maintaining the livestock production (Alemayehu et al., 2012). In 2013, the large camelids population was estimated to 27 million heads and small camelids to 8.8 million heads (FAOstat, 2015) not included feral Australian population. The camel population in 2013 was more than double than in 1961 (it was multiplied by 2.06), corresponding to annual growth of 2.1 %. By comparing this annual growth for the same temporal interval to other species at world level, the camel population was growing faster than cattle (1.01), sheep (0.20), horse (-0.12) and lama (1.15) and was close to the buffalo population growth (2.38), but lower than the goat population growth (3.24%). Obviously, the annual growth is quite variable from one country to another (from -2.1% in former soviet republics to 13% in Somalia) and different patterns were described (Faye and Bonnet, 2012).

Thus, even if the camelids are still marginal species compared to the other domestic herbivorous, the pressure they exert on the environment is increasing proportionally faster than the other farm animals. However, the camel density (number of camels per km²) is still low. The highest densities observed in the Horn of Africa and the United Arab Emirates are around 2 camels/km² and in Sahelian countries they don't overpass 1 camel/km². Finally, the question of the ecological footprint of the camelid stock could appear more acute in those regions of the world. However, it is the balance between the growth in camelid population and the ability to maintain a sustainable use of the resources that must be reached.

The preservation of camel biodiversity

Camelid diversity can be defined as the variability observed in these species including the totality of genes, breeds and ecotypes worldwide (Benton, 2001). The selection pressure by human on the camelid species was less important than for other ruminants like cattle, sheep and goat, except in alpaca for getting high quality fiber wool (Cervantes et al., 2010), or for racing camels in the Emirates (Anouassi and Tibary, 2013). However, few studies involved the identification of breeds with high dairy or meat potential, and up to now, the "camel Holstein" ou "camel Angus" was not available. In consequence, there is no "invading" breed at the world level and the biodiversity remains high, the traditional camel breeders having only oriented camel phenotypes for special use as packing, carting or riding. Several recent studies have proposed phenotypic classification by using different body measurements or descriptions for example in Saudi Arabia (Abdallah and Faye, 2012), in Tunisia (Chniter et al., 2013), in Algeria (Oulad Belkhir et al., 2013) or in India both (Makhdoomi et al., 2013). Since some years anyway, important advances and progresses were done in camelid genetic by mobilizing molecular tools in order to characterize the existing biodiversity (Mehta, 2014). For example in Saudi Arabia, 3 main genotypes covering at least 12 phenotypes were described (Almathen et al., 2012), probably at the origin of all the camels in the world. Similar studies were performed on small camelids (Obreque et al., 1999).

However, if the genetic characterization of camelid breeds has to be deepened and based on international consortium of scientists, the expected results permitted by molecular tools would be of limited interest without a clear characterization of the performances. There is a lack of national system of performances' control in all the "camel countries". On small camelids, the pressure of the international wool market has stimulated the implementation of herd-books in different countries with regular recording of the wool production and quality. The regular control of dairy production or young growth in camel, at reverse, is limited to big intensive farms or research stations. Moreover, there is no standardization of the measurements and scoring as body measurements or udder scoring (Ayadi et al., 2013).

Yet, the implementation of record systems of camel performances in different breeds and types, is essential for establishing proper selection program. In consequence the genetic progress, especially in camel species is less important than expected. In camel, the increase of milk and meat productivity was mainly linked to the population growth (Faye and Bonnet, 2012). The increase in meat production observed at world level was rather due to higher slaughtering rate rather than to higher individual productivity. Indeed, the mean carcass weight resulted to be the same in 2013 compared to 1961 (224 kg) while the slaughtering rate increased by 6.6% per year. The individual dairy productivity also did not change significantly since the last 50 years. The world annual growth of 5.5% reported by Faye and Bonnet (2012) results of the

demographic growth and a higher proportion of dairy animals passing from 62 to 69% of the total population. In most of the cases, the genetic progress is close to zero because the replacement's camels were selected not on the basis of their additive genetic values for growth traits or dairy production, but mainly on their appearance and conformation (Al-Mutairi et al., 2010).

The genetic characterization is also essential for the preservation of camel biodiversity, notably for protecting some ecotypes having low herd size or living in specific environment like the wild Bactrian camel (Silbermayr et al., 2010), Adhana camel bree'd in Saudi Arabia limited to mountains area (Faye et al., 2011) or Raigi camel breed in Pakistan (Raziq et al., 2011). Some breeds or types could have specific physiology interesting to be deepened for a better understanding of adaptation process like for Manga and Azarghaf camel breed in Niger characterized by two different reproduction cycle probably due to important physiological difference in the ovarian activity (Vias et al., 2006).

The effects of intensification

The camelidae family is characteristic of animals occupying remote areas arid lands or high mountains. This is linked to the close adaptation of those species to their ecosystem. Large and small camelids are able to valorize milieu characterized by dispersed resources, their low nutritive values and for camels, water scarcity. This explains the interest of this family for maintaining rural activities in the most inhospitable places of the earth. Their anatomy, physiology and behavior are designed to survive in such harsh environment. The consequences of intensification process of their management are obviously a big matter of issue, insufficiently approached by scientists. The large camelids are regarded as multipurpose animals (milk, meat, wool, skin, manure, transport, race, tourism, agricultural work and beauty contest). The intensification leads to specialization: camel dairy farms for milk production, feed-lots for meat production, racing stables for example. But except for race, the animals were rarely selected for such limited purpose.

In pastoral areas, the camel is able to graze a highest variety of plants than the ruminants, including halophytes grass, bush and trees, leading to a lower pressure on the floristic biodiversity of the arid lands (Rutagwenda et al., 1990). He has ambulatory and low gregarious behavior in pasture, passing more than 8 hours/day to graze (Faye and Tisserand, 1989) while, in intensive farms, he becomes settled and is fed with monotonous diet distributed twice a day. His digestive physiology (nitrogen recycling, slow transit, ruminal flora,…) allows him to better use low quality forages and leads to a better feeding efficiency than cow, contributing to a better resources/production ratio (Jouany, 2000). But, the consequences of a more limited feeding variability and more spaced meals on the rumen flora, on the feeding conversion, on the fattening, or on metabolic disorders are not sufficiently studied.

The camel milk is reputed for its medicinal virtues, true or supposed (Konuspayeva et al., 2004), and the nomads attribute those health effect to the milk composition linked to the desert plants. The impact of the changes in feeding practices (low diet variety, spaced meals) on the milk composition and medicinal activities is not really investigated as well as on the nutritive value and chemical composition of the camel meat (Kadim et al., 2008).

Regarding the water management, the intensification leads also to higher expenses in water. It has been assessed in Saudi Arabia where camel farming systems are moving from extensive form (Bedouin system based on camel mobility, low inputs, pastoral feeding) to semi-intensive or even intensive systems (based on feeding by irrigated feedstuffs, settlement and high market integration)(Abdallah and Faye, 2013), that , the water consumption increased from 3,000 m^3/ha to 35,000 m^3/ha and the biomass productivity passing from 5 tons to 18 tons of dry matter per hectare, the water consumption for feeding one camel is multiplied by 3.2 contributing to higher pressure on water resource. The assessment of water consumption per liter of produced milk is multiplied by 9 passing from 938 to 8601 l per liter of produced milk (Faye, 2013). At the national level, compared to the situation in 1961 where almost all camels were reared in the Bedouin system, the water consumption in Saudi Arabia increased approximately from 180,000 m^3 to 280,000 m^3 in the Bedouin system while it passed from 7,000 to 860,000 m^3 in intensive system during the last 50 years (Faye, 2013). Thus, the intensification process in camel sector has a strong effect on water demand which could be an important constraint for sustainable development

The technical model adopted in intensive camel farms is based on irrigated alfalfa plus concentrates like barley and/or wheat bran. Yet, agro-food by-products could be partially one alternative. Olive cake already tested in camel (Faye et al., 2013) or date blocks, widely available in desert countries, could be used for a more sustainable feeding system. Alternative ingredients for feeding high-yield camel like fodder produced under salty water irrigation is also a convenient approach for contributing to a better balance between natural resources and camel production (Breulmann *et al*., 2007).

Transboundary diseases

If the small camelids market is limited to the national level, the dromedary meat is subject to a regional market leading to an important flow of live camel stock, especially from the Sub-Saharan countries and Horn of Africa to northern Africa and Arabian Peninsula (Aklilu and Catley, 2011). The sustainability of this market is depending on two main aspects: (i) the security and (ii) the risk of transboundary diseases.

The camel stock market for export is widely "informal" (no official declaration) and if the commodity channel is well organized (based on oral agreements and tribal relationships between the stakeholders of the commodity channel), the economic importance of this market at national level is not well documented (Alary and Faye, 2009). This lack of official implementation contributes to the insecurity all along the trade routes, especially in countries where local conflicts occur (especially in the Horn of Africa).

Regarding health aspect, diseases are of particular concern when camels are forced to live outside of their natural habitat. In the exporting countries, the veterinary services are not necessary well trained for camel health care and accustomed to camel diseases prevention. Mange, plant poisoning or tick infestations are common. Emerging diseases provoking high mortality are also regularly described (Khalafalla et al., 2010; Roger et al., 2000). In Saudi Arabia, the origin of Rift Valley Fever outbreak occurring in the years 2000 and killing several hundred people was attributed to the importation of animals (small ruminants and camels) from the Horn of Africa (Balkhy and Memish, 2003). More recently, the MERS-Coronavirus is suspected to be involved in the transmission from camel to human (Gossner et al., 2015) and the risk of exportation of the virus is mobilizing the World Health Organization. Because of the increase in the risk of transboundary diseases in camel, the World Animal Health Organization (OIE) in Paris has implemented one *ad-hoc* group of experts on camel diseases for establishing rules and standards (nomenclature of diseases, diagnosis kits, references lab, etc).

The future social role of camel

A sustainable camel socio-economy involved the ecosystem services offered by the camel farming systems to the society as well as the negative "externalities" of the camel farming activities on the environment.
The anthropologists have already underlined the social role of camel in the nomad way of life or small camelids in the Indian community. But in a more and more urbanized world (including the developing countries), the social role of camelids has to be reconsidered at the light of the changes in the society. If in low input systems of Africa and Asia, camel is an element of the social prestige of the owners, a capital for ensuring the well-being of their family, and, due to its remarkable resistance to drought, a security face to the climatic changes as it was observed in Sahelian countries (Faye et al., 2012) contributing to the poverty alleviation (Vias and Faye, 2009), the changes in the farming systems enlightened above, could modify also how the camel is perceived. The "traditional life" in the desert is regarded as a "harmonious, symbiotic relationship with the environment" (Breulmann et al., 2007), the pastoralists managing their fragile rangelands without over-exploiting them (Olsvig-Whittaker et al., 2006). Camels fulfil the dreams of desert men, help to describe their environment, and still inspire poets. But he also recalls outdated images based on ignorance and prejudice, which confine it to the past or even obsolete positioning. This ambiguous relationship is reflected in social behaviors, in popular symbols and in some development policies implemented by decision-makers. Nowadays, relationships with the camel in both Northern and Southern societies are still ambiguous, moving between marginalization and idealization (Brey and Faye, 2005).
However, the changes in the camel farming systems don't destroy the proximity to the nature including the emotional links with the camels. For proof, in spite of the new standard of life developed in Middle-East, the search for the quality of life, by passing for example the week-end under the Bedouin tent surrounded by the camel herd, is still expected by the recently urbanized people. The challenge of the new camel farming systems based on the intensification of the management and production would be to maintain this relationship.

Conclusion

Obviously, the sustainable development is not a challenge for the only camelids, but as "the animal of the desert" (camel) or "animal of the Andean highlands" (small camelids), their responsibility is particular because they contribute strongly to the maintenance of rural activities and household economy in the much remote places of the earth, except the Polar Regions. The intensification is not the ineluctable way, but henceforth the camelids' breeders have to contribute in the same time to maintain the diversity, to better manage their resources for providing products with high added-value expected by urban population, and to preserve the future of their animals.

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FROM PALAEONTOLOGY TO ZOOARCHAEOLOGY, IMPORTANCE OF THE CAMELS THROUGH TIME AND HISTORY

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Abstract

This presentation will trace the evolution of camels, since their most distant origins in the American tertiary until the appearance of the genus *Camelus* in the Pleistocene (Palaeontological phase). Following this brief outline I will discuss the emergence of the current species, the dromedary (or the Arabian camel, *Camelus dromedarius*) and the Bactrian camel (*Camelus bactrianus)* with a particular emphasis on the domestication of these species, focusing on the dromedary in the south of the Arabian Peninsula (*Zooarchaeological phase*).

ПАЛЕОНТОЛОГИЯДАН ЗООАРХЕОЛОГИЯҒА ДЕЙІН, УАҚЫТ ПЕН ТАРИХТАҒЫ ТҮЙЕНІҢ МАҢЫЗДЫЛЫҒЫ

Бұл презентацияда түйелердің Америка территориясындағы ең алыс ата-бабаларынан Плейстоценде (Палеоонтологиялық фаза) пайда болған Camelus түріне дейін шолу көрсетіледі. Бұл қысқа шолудан кейін қазіргі кездегі түрлердің, дромедарлар (немесе Араб түйелері, Camelus dromedarius) және бактриандар (Camelus bactrianus) пайда болуы, Араб түбегінің оңтүстігінде үй жануарына айналуын ерекшелей отырып талқылау жүргізіледі (Зооархеологиялық фаза).

ОТ ПАЛЕОНТОЛОГИИ ДО ЗООАРХЕОЛОГИИ, ВАЖНОСТЬ ВЕРБЛЮДОВ ВО ВРЕМЕНИ И ИСТОРИИ

Эта презентация посвящена развитию верблюдов от их самых дальних предков в третичном периоде на Американском континенте до появления рода Camelus в Плейстоцене. После этого краткого описания будет описано появление нынешних видов, дромедаров (или Арабских верблюдов, Camelus dromedarius) и Бактрианов (Camelus bactrianus) с особым акцентом на одомашнивании этих видов, фокусируясь на дромедарах юга Аравийского Полуострова (Зооархеологическая фаза).

Foreword: Camelids are members of the biological familiy Camelidae, the only currently living family in the suborder Typolopoda. The extant members of this group are: dromedary camel, Bactrian camels, wild or feral camels, llamas, alpacas, vicunas, and guanacos. Camelids are even-toed ungulates classified in the order Artiodactyla, along with pigs, hippopotami, deer, giraffes, cattle, goats, antelope, and many others.

Etymology: The scientific name of the dromedary camel is *Camelus dromedarius*, a word which could be based on the Greek *dromas kamelos* meaning 'running camel'. The term 'dromedary' comes from the Old French word *dromadaire*, or