

Animal welfare a giant economic venture in the era of climate challenge–A review

ARUN VARMA¹

National Institute of Animal Welfare, Animal Welfare Division, Seekri, Ballabhgarh, Haryana 121 004 India

Received: 4 April 2010; Accepted: 17 October 2010

ABSTRACT

Animal welfare in the current world of science is conceptualized as physical and psychological state of animal, and is influenced by environmental and genetic factors. Scientific information is the base for the preparation of universally acceptable codes and practises of animal welfare science. These codes and practices should be appropriately evaluated and validated taking into account the different circumstances and contexts relevant to the system. Thus there is a need to promote scientific research and capacity building and communication.

The animal welfare science is a science of safe food production system, biodiversity conservation of AnGR, addressing problems of climate change and biggest of all capacity of engaging very big mass of unemployed and underutilized youth of the country. The science is the responsibility of environment, agriculture, commerce, law and justice, human resource development and many others ministries to deal it holistically. Food safety, biodiversity, environment safety, central zoo and disaster management authorities all have to marshal their resources to develop codes, practices and standards to fulfill the objectives of all four areas where this science will be used.

The current paper highlights the issues, concerns and future prospects of a very noble role of animals in the era of climate change. The paper is in five parts introduction, animal welfare a holistic view, uses of animal welfare, global concerns and issues, livelihood and employment potential. Animal welfare science is concern of all global forums such as FAO, OIE, WHO, WTO, CBD and IPCC. Thus the science of animal welfare is a giant economic venture in the era of climatic changes. In future 15 major sectors will engage the manpower trained in animal welfare.

Key words: Animal welfare, Employment potential, Livelihood

Animal welfare has a long history and unequivocal support throughout the world. Even in the Vedic Literature, Islamic verses (Masri 1993) and as per biblical philosophy human concern is to treat animals with love and compassion. Animal welfare standards need to be democratically and transparently adopted as scientific and ethical bases of animal system. The above principle is relevant in each environmental, geographic region economic, cultural and religious scenario (OIE 2008). The second OIE Global Conference on Animal Welfare held in Cairo, Egypt also confers the above view and relevance for each environmental, geographic, economic, cultural and religious scenario (OIE 2010).

In India, animals forms are regarded as incarnation of God and regarded as angels to grant blessings and good will to mankind. They are worshiped in religious and festive seasons, and also during child birth and marriages. Animal welfare has a long history, very variable school of thoughts and standards but no disagreement on human role to disregard them.

Present address: ¹Former Project Advisor, National Institute of Animal Welfare, Animal Welfare Division (Ministry of Environment and Forest), B-4, Sector -12, Noida, Uttar Pradesh 201301 (email: dr_avarma@rediffmail.com).

Saunders Comprehensive Veterinary Dictionary defines animal welfare as “the avoidance of abuse and exploitation of animals by humans by maintaining appropriate standards of accommodation, feeding and general care, the prevention and treatment of disease and the assurance of freedom from harassment, and unnecessary discomfort and pain”.

Welfare is also defined as “its state (physical biological and mental) as regards its (the animal) attempts to cope with its environment. This state includes how much it has to do to cope, the extent to which it is succeeding in or failing to cope, and its associated feelings.” He states that “Welfare will vary over a continuum from very good to very poor. Broom suggests that studies of welfare will be most effective if a wide range of measures is used” (Broom 1986,1996).

Animal welfare education

World: Animal welfare education is imparted in universities all over the world. Important among them are University of Cambridge (Welfare concepts and assessment, Law and companion animal welfare, Farm animal welfare), Canadian Council of Animal Care, University of British Columbia (Animal Welfare Programme addresses the issue of use of

animals for agriculture, research and companionship, concerns regarding humane animal care and management and questions regarding the appropriation of using animals for this traditional purpose) Animal Welfare Centre, University of Melbourne (Melbourne, campuses included welfare mythologies and factors related with welfare).

The centre conducts two years Master Programme in animal welfare related education programmes: The “Animal Welfare Centre” uses the research facility of the AWC, Pig Research and Training Centre (PRTC), Joint Facility for Food Animal Research (JFFAR www.animalwelfare.net.au/about/about.html) and Meat Research and Training Centers located at Multimedia Lab Monash University and Caulfield campus Dookie, Glenormission and Longerenong College, World Society for Protection of Animals (WSPA), University of Bristol: WSPA has been conducting training programme on Animal Welfare.

Synthesis of animal welfare courses in India: The report revealed following facts. Tamil Nadu University of Veterinary and Animal Sciences, Chennai and Veterinary Council of India are still in the process of updating and revising the animal welfare related courses to address animal welfare in its true sense of absolute animal welfare in line with Five Freedoms. Farm animal welfare has the backing of veterinary sciences and is in better position as compared to wild animal, pet animals and aquatic animal welfare (Varma and Chandrashekhar 2005).

A market demand study of Animal Welfare Education Programme for National Institute of Animal Welfare was conducted on the instance of Animal Welfare Division of Ministry of Environment and Forest. The study was undertaken by Educational consultant India Ltd and published document under the title “Market demand study of Animal Welfare Education Programme for National Institute of Animal Welfare” (Varma 2007). The study brought out following revealing facts.

There is a nationwide support and demand for having a strong base of animal welfare education in India. Socio-political, socio-religious and economic forces are also compelling Government to take action in this direction. Very few in public and selected organizations do have the needed scientific perception on the role of animal welfare sciences in food safety and conservation of AnGR and environment safety (Varma 2005).

Welfare of farm, wild, pet, aquatic and other animals plays no less important role among themselves and all complement each other. Even hygiene and human safety are affected due to lack of animal welfare education in the country. Comfort, cruelty, norms of housing, transport and prevention of diseases are still not addressed properly in the system of abattoirs, animal houses, transport, animal traction, pet animal houses, captive animal breeding (stud book) programme. Even the *Gaushalas* are not strict in providing behaviour norms of cows.

Pattern of animal welfare education abroad is for farm animal welfare and to uphold ethical standards of replacement, reduction, and refinement in research. There are specialized courses for laboratory animal welfare or pet animal care. The above study also revealed that the animal welfare education throughout the world has still not received its due. This is inclined too much towards absolute animal welfare and support animal rightist view or it supports value chains of the production system to help the production base of farm animal welfare. In last four-and-half years after the start (2 January 2006) more than 50 training courses were conducted in NIAW. The study revealed that India needs a holistic animal welfare education in view of the compassion, biodiversity conservation, food safety, climate change and production system related to animals. In India sustainable development, economics and potential of employability are the other issues of consideration.

1. Animal welfare: A holistic view

The science: The science of animal welfare (Dawkins and Marian Stamp 2006, Varma and Chandrasekhar 2007) has three classes — the Science of Emotion and Feelings, Science of Biological functioning in variable ecosystem, and the Science of meeting natural living needs of animals. The animal welfare education may be planned on following lines: Core courses (common for all), Specialized courses, Integrated courses and Sister courses (common for all). These courses should be specific to: Zoo Technician, Animal Nursing, Animal Welfare Laws and their dispensation, Animal Transport, Animal Behavior, Animal Economics, Animal Life Support Systems, Animal Housing, Animal Management and Nutrition, Breeding in Captivity, Aquatic Management, Kennel Management, Animal Experimentation, Veterinary Pharmacy and Drug Dispensing.

Stakeholders demanded some specialized educational programmes after the faculty gets established as continuing educational programme for the persons who are employed in animal based projects. Approximately 21 programmes were suggested (Varma 2005) — ABC (Animal Birth Control) Programmes, Small animal care unit management, Guideline of shelters management, Complementary therapies for animals, Animal sacrifice alternatives, Gaushala management, Elephant shelters management mahout Training, Bird hospitals management, Monkey shelters management, Legal training and counseling, Animal welfare issues, Laboratory Auditing and management, Slaughter houses management, Examination of commercial animal establishments, Conducting campaigns, In-service programmes, distance education programmes, virtual learning programme, e-learning; HACCP programmes for dairy management; Experimental animal rehabilitation.

Group of sciences in animal welfare

- (i) As referred above core courses relates to the principle

of animal welfare in relation to biological function of animal, food, water, thermal stress, fear, strain, pathology, infection, immunology and gene expression and history of earth in relation to origin and extinction of animals. Animal behaviour sciences and courses should have bulk of data base education with practical orientation and exposure.

- (ii) The second group of science is basic and fundamental sciences e.g. molecular genetics, gene expression, neurosciences, endocrinology, immunology and disease control.
- (iii) The other animal welfare sciences are related with animal based food sciences, conservation of animal genetic resources and environment based animal welfare sciences. These are highly professional courses.
- (iv) Fourth group of sciences are GPS, GIS and IT based sciences. These are the tools to be applied in disaster management and mitigation technologies.
- (v) The other group of animal welfare education is based on social sciences and science of humanities. These are courses on ethology, religion and animal management.
- (vi) The sixth group of sciences is on codes and practices of farm, pet, wild and aquatic animal welfare.

The Science of Animal Welfare has its biggest application in food safety, conservation of animal genetic resources and IPR (for those who contributed in conservation of rare genetic material) and also addressing and applying mitigation strategy to overcome the ill effect of climate change during floods, earthquake, drought and other hazards (Varma 2007).

Animal ethics

After the science it is ethics of animal welfare, which should be conceived in its true sense of love, compassion and behaviour of man towards non human (animal). Darwin was the first western scientist who recognized that animals also have emotions like man, in his research using images was expanded in his 1872 book *"The Expression of the Emotions in Man and Animals"*, one of the first books to feature printed photographs, which discussed the evolution of human psychology and its continuity with the behaviour of animals. Charles Darwin's conclusion was "that man with all his noble qualities, with sympathy which feels for the most de-based, with benevolence which extends not only to other men but to the humblest living creature, with his god-like intellect which has penetrated into the movements and constitution of the solar system—with all these exalted powers—man still bears in his bodily frame the indelible stamp of his lowly origin."

Animal Welfare Philosophy "marks an expansion of our moral horizons beyond our own species and is thus a significant stage in the development of human ethics" - Peter Singer. The subject of animal ethics include Animal Right and Intrinsic value (animal ethics), abolitionism (animal

rights), and anthrozoologists (human animal relation) and central.

Principle of Theo Right (TR): Theo-rights denote God's own rights as creator to have what is created must be treated with respect. According to this perspective, rights are not awarded, negotiated or granted but recognized as something God given. In other words "When we speak of animal rights, we conceptualize what is objectively owed to animals as a matter of justice by virtue of their "Creator's" right. God has the right to have all creatures treated with respect" (Andrew 1994).

Animal laws

Definition of animal law: Animal law is defined as a combination of statutory and case law in which the nature – legal, social or biological of non-human animals are important subjects. Animal law is used in developing codes and practices of farm animals, companion animals, and wildlife in captivity and in nature, and also animals used in experiments and entertainment and animals raised for food fur and traction.

Global issues: The emerging fields of animal laws are animal based food, biodiversity loss and also climate change. Animal laws are also linked to the environmental law movement IPCC, OIE and WTO. Animal law has been taught in at least 108 law schools in the USA, including Harvard, Stanford, UCLA, Northwestern, University of Michigan and Duke, and is currently taught in at least 106 schools. Animal law is also currently taught in 7 law schools in Canada (Varma and Chandrasekhar 2005).

National Acts to address animal welfare: Smt Rukmani Devi as a member of the Upper House (Rajya Sabha), was instrumental for the legislation for the 'Prevention of Cruelty to Animals Act (1960)', and for later setting up of the Animal Welfare Board of India, under her chairmanship in 1962.

Constitution of India provides protection to animals: The Constitution of India Provides Animal Protection by Article 51 Ensuring "Compassion to all Living Creatures". Further, in pursuance of the recommendations of Datter Singh's Committee for providing prohibition of slaughter of cows and its progeny, the constitution in its Directive Principle of state policy provided protection to cow and its progeny by prohibiting slaughter of all milch animals, which especially identified cows and calf.

(i) *Animal Welfare Board of India:* AWBI was set up in accordance with Section 4 of the Prevention of Cruelty to Animals Act 1960 (No.59 of 1960). (awbi@md3.vsnl.net.in).

The Board consists of 28 Members. The Prevention of cruelty to animals act, 1960 (59 of 1960) (26 December 1960)

Mission: Endeavour of AWBI is to make the Animal Welfare Movement board-based by creating a social awakening to the philosophy of Bio-diversity preservation and recognition of rights of animals to life, liberty and

relationship with nature.

Functions of Animal Welfare Board of India

- To keep the law in force in India for the Prevention of Cruelty to Animals under constant study and to advise the government on the amendments to be undertaken in any such law from time to time.
- To advise the Central Government on the making of rules under the Act with a view to preventing unnecessary pain or suffering to animals generally, and more particularly when they are being transported from one place to another or when they are used as performing animals or when they are kept in captivity or confinement.
- To advise the Government or any local authority or other person on improvements in the design of vehicles so as to lessen the burden on draught animals.
- To take all such steps as the Board may think fit for amelioration of animals by encouraging, or providing for the construction of sheds, water troughs and the like and by providing for veterinary assistance to animals.
- To advise the Government or any local authority or other person in the design of slaughter houses or the maintenance of slaughter houses or in connection with slaughter of animals so that unnecessary pain or suffering, whether physical or mental, is eliminated in the pre-slaughter stages as far as possible, and animals are killed, wherever necessary, in as humane a manner as possible.
- To take all such steps as the Board may think fit to ensure that unwanted animals are destroyed by local authorities, whenever it is necessary to do so, either instantaneously or after being rendered insensible to pain or suffering.
- To encourage by the grant of financial assistance or otherwise by formation or establishment of Pinjarapoles, rescue homes, animal shelters, sanctuaries and the like, where animals and birds may find a shelter when they have become old and useless or when they need protection.
- To co-operate with, and co-ordinate the work of associations or bodies established for the purpose of preventing unnecessary pain or suffering to animals or for the protection of animals and birds.
- To give financial assistance and other assistance to Animal Welfare Organizations functioning in any local area or to encourage the formation of Animal Welfare Organizations in any local area which shall work under the general supervision and guidance of the Board?
- To advise the Government on matters relating to the medical care and attention which may be provided in animal hospitals, and to give financial and other assistance to animal hospitals whenever the Board think it is necessary to do so.

- To impart education in relation to the humane treatment of animals and to encourage the formation of public opinion against the infliction of unnecessary pain or suffering to animals and for the promotion of animal welfare by means of lectures, books, posters, cinematographic exhibitions and the like.
- To advise the Government on any matter connected with animal welfare or the Prevention of infliction of unnecessary pain or suffering on animals.

(ii) *PCA – Act (The Prevention of Cruelty to Animals Act, 1960 (59 of 1960) – 26 December 1960)*: PCA Act is to prevent the infliction of unnecessary pain or suffering on animals and for the purpose to amend the law relating to the prevention of cruelty to animals. There are several rules under the PCA act to strengthen its provisions.

Rules under PCA-Act 1960

- Breeding of and Experiments on Animals (Control and Supervision) Amendment Rules, 2006 Reconstitution of Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA)].
- Breeding of and Experiments on Animals (Control and Supervision)
- Amendment Rules, 2005 the Animal Birth Control (Dogs) Rules, 2001
- The Performing Animals (Registration) Rules, 2001
- The Performing Animals (Registration) Amendment Rules, 2001
- The Prevention of Cruelty to Animals (Establishment and Regulation of Societies for Prevention of Cruelty to Animals) Rules, 2001
- The Prevention of Cruelty to Animals (Slaughter House) Rules, 2001
- The Prevention of Cruelty to Animals (Transport of Animals on Foot) Rules, 2001
- The Breeding of and Experiments on Animals (Control and Supervision) Amendment Rules, 2001
- The Breeding of and Experiments on Animals (Control and Supervision) Rules, 1998
- The Experiments on Animals (controls and Supervision) (Amendment) Rules, 1998
- The Prevention of Cruelty (Capture of Animals) Rules, 1972
- The Prevention of Cruelty to Animals (Registration of Cattle Premises) Rules, 1978
- The Transport of Animals Rules, 1978
- The Transport of Animals (Amendment) Rules, 2001
- The Prevention of Cruelty to Animals (Application of Fines) Rules, 1978
- The Performing Animals Rules, 1973
- The Prevention of Cruelty to Animals (Licensing of Farriers) Rules, 1965
- The Prevention of Cruelty to Draught and Pack Animals Rules, 1965, amended on 1968

- Notification: Prevention of Cruelty to Animals (Restricted to Exhibit on Trained as a Performing Animals)

Control and supervision of experiments

Committee for the Purpose of Control and Supervision of Experiments on Animals: CPCSEA is a committee (Varma 2007, Varma 2010) for the Purpose of Control and Supervision of Experiments on animals. This is a national regulatory body constituted under the Act of Parliament—Provision of Section 15 of PCA Act, 1960.

Animal Welfare Board of India under the Chairmanship of Secretary Department of Bio Technology in the year 2002 formulated CPCSEA Laboratory Guidelines for Laboratory Animal Facility. The goal of these guidelines is to promote the humane care of animals used in biomedical and behavioural research and testing with the basic objective of providing specifications that will enhance animal well-being, quality in the pursuit of advancement of biological knowledge that is relevant to humans and animals. These guidelines were officially provided to all CPCSEA nominees. It is expected that all officially nominated members of Animal Welfare Division of Ministry of Environment and Forest would be using these guidelines when they are authorized by MoEF to use constitutional powers to inspect research facilities in the country. Sometimes institutions of international standards are using these facilities e.g. All India Institute of Medical Sciences, Indian Institute of Science and Indian Veterinary Research Institute Izatnagar.

The main objective of PCA Act 1960 is to prevent infliction of unnecessary pain and suffering to animals. The Act provides duties and power to CPCSEA through their constitutionally approved members.

Duties and powers of CPCSEA members: Create awareness among medical/veterinary/pharmaceuticals/biological/life science establishment that conduct or involved all categories of animals to be carried out with sensitivity to avoid unnecessary pain and suffering experienced by animals.

To examine and audit the conduct of good laboratory practice with intension to assure quality and safety norms to animals engaged in the experiments.

Suggestions: Second Generation Reforms are urgently needed (Varma 2010). A National Seminar on Committee for the Purpose of Control and Supervision of Experimental on Animals with objective of discussing guideline, rational use of animals in experiments and welfare measure and rehabilitation mechanism of experimental animals, need to highlight the current status and future amendments and improvement, was held in January 2010.

This presentation entitled “Second generation reforms in CPSCEA guidelines in the era of climate change” applies the policy statement of MoEF in developing animal welfare education and suggesting second generation reforms in CPSCEA guidelines.

Principles of animal welfare

Brambell’s report, the UK government set up the Farm Animal Welfare Advisory Committee in 1967, which became the Farm Animal Welfare Council in 1979. The committee’s first guidelines recommended that animals require the freedom to “stand up, lie down, turn around, groom themselves and stretch their limbs”. The guidelines have since been elaborated to become known as the Five Freedoms.

- Freedom from thirst and hunger—by ready access to freshwater and a diet to maintain full health and vigour.
- Freedom from discomfort—by providing an appropriate environment including shelter and a comfortable resting area.
- Freedom from pain, injury, and disease—by prevention or rapid diagnosis and treatment.
- Freedom to express normal behaviour—by providing sufficient space, proper facilities and company of the animal’s own kind.
- Freedom from fear and distress—by ensuring conditions and treatment which avoid mental suffering.

Concern on animal welfare awaiting address

Concern for farm animals is mainly focused on intensive animal farming and high turnover, where farm animals are raised in artificial light and confinement and caring little of behavioural and environmental enrichment of farm animals. Other issues include ritual animal sacrifice and slaughter. The two teeth PCA Act 1960 and CPCSEA–2002 are too weak and too blunt to address what humanity has promised to the other companion living being on earth.

In the case of wild and captive animals, science-based assessment of animal welfare has to rely on behaviour and Genetic Expression. Detailed physiological data of free-living animals is scanty and it is difficult to be applied in captive animals in zoo or safaris. With regard to the science-based assessment of welfare in aquatic animals, a discussion is provided on the issues that complicate this process, viz. the huge biological diversity among these animals; understanding the practices involved in fisheries, aquaculture, and aquatic animal production; the relative paucity of scientific information; and understanding the philosophical approaches, policies, guidance, and regulations that may affect the provision of optimal welfare conditions and humane practice for aquatic animals (Varma 2009).

Animal welfare assessment

Principles applied in Animal Welfare are based on the assessment of physical and psychological state of animal body and behaviour. These addresses the value of issues considered important for improving the good quality of life of animal. It is affected when animal feelings and emotions are also taken into consideration.

Feeling base approach: Adverse feelings of animal affect

the quality of life adversely, which also reflects in poor performance. A high quality of life in animals is related to comfort, contentment and the normal pleasure of life. Thus the primary principle of this approach is addressing feeling and emotional needs of animals. I quote the words of an animal lover "Just look at them, listen to them, and watch them carefully when they interact with friends and foes. Look at their faces, tails, bodies and, most importantly, their eyes. What we see apparently from outside tells us a lot about what is happening inside".

Neuro-scientific research has also shown, using functional magnetic resonance imaging (fMRI), that elephants have a huge hippocampus, a limbic system a brain structure important in processing emotions.

Biological function assessment approach: It is achieved by satisfying species-wise and breed-wise biological function of the animal in the area of growth, reproduction, immunity and behaviours.

Natural living status assessment: Under this principle animal must get breed, species and habitat specific environment. They should be allowed to develop and use their natural adaptation and capability (Gene Expression). These are applied in environment and behavioural enrichment of habitat of endangered species of animals.

Assessment of the changes of the climate

The impacts of climate change and global warming are scary when considered one by one. The view becomes much worse when one looks at them together. Unpredictable weather makes it very hard for farmers to plan from month to month and year to year. Hurricanes in the Caribbean and the United States, extensive droughts in Eastern Africa, Australia, Southern Europe and parts of China and India and uncontrollable floods in many parts of the world such as Bangladesh and South Bihar. Many a time's floods are preceded by a long drought, by Tsunami earthquake, and droughts by floods and tropical cyclones/hurricanes. The long climatic changes in 480 million years since the existence of animals on earth these climatic changes created conditions when out of 1,000 animal 999 are no more living on earth. These catastrophes are known as extinctions. Earth has faced five extinctions.

2. Food quality and safety

The sedentary way of life and changing food habits are causing health hazards in human beings. Chronic diseases like diabetes, coronary thrombosis, hypertension and adiposity are becoming perpetual problems in the modern society. Food safety and nutritional security are important aspects of the food chain system of animal based fast food culture. The fast chains are amongst the most flourishing business of the food industry. Multinational corporations typically modify their menus to cater to local tastes and most overseas outlets are owned by native franchisees. One such

fast food chain uses lamb rather than beef in its burgers because of religious reasons in India. In Muslim countries this changes to meet client demand. Animal welfare based production is foremost in addressing and controlling the above problem.

It is a concern of very large population of developed world and fast food and trans-food industries (CR Report 2008). Codes of animal welfare standards are now developed to address safety and public demand of human safe meat, egg and milk (Animal Welfare Food Code of Canada). In India this science is in a very early phase.

Climate safe food production system: This concept on climatic evaluation of livestock food production system (dairy, poultry, mutton and beef) is recently termed by measuring food miles, however more recently this simple concept has been replaced by the development of more comprehensive life cycle assessments and carbon footprints.

Carbon footprints report the total levels of greenhouse gas (GHG) emissions from food production, but do not document the actual geographic location of the emissions. However in the era of climate change it may be evaluated more precisely on carbon sequestration base. This means arrest all generated carbon there itself i.e carbon sink.

As the emissions of GHGs from soils and livestock occur on farm they are defined as being local. As a result their inclusion in the carbon footprint changed the carbon map considerably, and greater than 50% of all total GHG emissions then occurred locally.

Almost all the farms in England and many other European countries derive inputs from outside and consequently they are responsible for both the depletion of distant carbon stocks, and GHG emissions that occur outside their locality and continent.

The concept of a carbon map offers a method to represent and address the level of regional problem for any production system. However, it is now known that this information would be of benefit to consumers. Science animal welfare plays very important role in improving the process in food chain system and educate professionals and/or policy makers. Vision Document Ministry of Food Processing and Industry addresses these issues in Food Safety Bill-2006.

3. Biodiversity conservation

The amount of diversity at the genetic level is important because it represents the raw material for evolution and adaptation. More genetic diversity in a species or population means a greater ability for some of the individuals in it to adapt to changes in the environment. Less diversity leads to uniformity, which is a problem in the long term, as it is unlikely that any individual in the population would not be able to adapt to changing conditions in the ecosystem.

Professional biologists now believe that earth is currently faced with a mounting loss of species that threatens to rival the five great mass extinctions of the geological past. Harvard

biologist E.O. Wilson estimated that earth is currently losing something on the order of 30,000 species per year — which breaks down to the even more daunting. Statistics of some calculate loss of three species per hour (Blackburn 2004).

Farm and domestic animal's biodiversity: Livestock have special role to play in human civilization. Over 70% of the world's rural poor depend on livestock as a component of their livelihoods. The global livestock sector consists of a variety of production systems in which farm animals are used for a variety of functions. Animal based food production is the most important role amongst all other roles. Proportion of domestic animals in supply of food is 30% of total human requirements in agriculture.

Centuries of selective breeding and exchange of farm animals or germplasm among users within and across countries have resulted in the development of the current diversity of breeds and within-breed genetic diversity. The exchange of AnGR has played and will continue to play an important role in breed and livestock sector development. Although detailed quantitative data about gene flow between countries and continents is not available, different AnGR flow directions can be characterized to a large extent (Hiemestra *et al.* 2006).

The recent global gene exchange trade is the interest of biotechnology based trade (Commission on Genetic Resources for Food and Agriculture, FAO Rome 2007). Earlier the guidelines issued by IPCC, WTO and OIE need to be included in developing codes of practices of animal welfare addressing issues of biodiversity loss.

Biodiversity conservation for wild and threatened species: UN Secretary General in his message on World Earth Day—2010 echoes' the call to stop mass extinction and raise the awareness about the vital importance of millions of species that inhabit our planet, soil, forests, oceans, coral reefs and mountains.

For the purpose of research on conservation of biodiversity of AnGR an understanding of three levels of biodiversity are taken into consideration, these are genetic, species, and ecosystem. These levels are all interrelated yet distinct enough that they can be studied as three separate components. Some researchers believe that there are fewer or more levels than these, but the consensus is that 3 levels, is a good number to work with.

Most studies, either theoretical or experimental, focus on the species level, as it is the easiest to work on both conceptually and in practice. The following parts will cover all levels of diversity, though examples will generally use the species level.

Genetic diversity: Genetic diversity can be measured at many different levels, including population, species, community, and biome. Which level is used depends upon what is being examined and why, but genetic diversity is important at each of these levels. Genetic diversity is the variety present at the level of genes. Genes, made of DNA

(right), are the building blocks that determine how an organism will develop and what its traits and abilities will be. This level of diversity can differ by alleles (different variants of the same gene, such as blue or brown eyes), by entire genes (which determine traits, such as the ability to metabolize a particular substance), or by units larger than genes such as chromosomal structure. Following issues are important while modeling understanding on Animal Welfare Codes for restricting future AnGR losses.

- i. The amount of diversity at the genetic level is important because it represents the raw material for evolution and adaptation.
- ii. More genetic diversity in a species or population means a greater ability for some of the individuals in it to adapt to changes in the environment.
- iii. Less diversity leads to uniformity, which is a problem in the long term, as it is unlikely that any individual in the population would not be able to adapt to changing conditions in the ecosystem.
- iv. *Environment:* Within species, genetic diversity often increases with environmental variability, which can be expected. If the environment often changes, different genes will have an advantage at different times or places. In this situation genetic diversity remains high because many genes are in the population at any given time. If the environment did not change, the small number of genes that had an advantage in that unchanging environment would spread at the cost of the others, causing a drop in genetic diversity.
- v. In communities it can increase with the diversity of species. How much it increases depends not only on the number of species, but also on how closely related the species are.
- vi. Species that are closely related (e.g. two species of maple) have similar genetic structures and makeup and therefore do not contribute much additional genetic diversity. These closely-related species will contribute to genetic diversity in the community less than more remotely-related species (e.g. a maple and a pine) would.
- vii. An increase in species diversity can also affect the genetic diversity, and do so differently at different levels. If there are many species, the genetic diversity at that level will be larger than when there are fewer species. On the other hand, genetic diversity within each species can decrease. This can happen if the large number of species means so much competition that each species must be extremely specialized, such as only eating a single type of food. If they are so specialized, this specialization will lead to little genetic diversity within any of the species.
- viii. *Species diversity:* Biodiversity studies typically focus on species. They do so, not because species diversity is more important than the other 2 types, but because

species diversity is easier to work with. Species are relatively easy to identify by eye in the field and can be studied more precisely.

- ix. Genetic diversity requires laboratories, time and resources to identify and ecosystem diversity needs many complex measurements to be taken over a long period of time. Species are also easier to conceptualize and have been the basis of much of the evolutionary and ecological research that biodiversity draws on.
- x. *Species are well known and are distinct units of diversity study*: Each species can be considered to have a particular “role” in the ecosystem, so the addition or loss of single species may have consequences for the system as a whole. Conservation efforts often begin with the recognition that a species is endangered in some way, and a change in the number of species in an ecosystem is a readily obtainable and easily comprehensible measure of how healthy the ecosystem is.

xi. *Approaches*: Genetic erosion may be minimized through complementary *ex situ* (*in vitro*) and *in situ* conservation approaches organized at national, regional and/or global levels. Such approaches should take into account different views of the ‘unit of conservation’. A variety of different strategies are available to stimulate *in situ* conservation, including strengthening of breeding capacity and programmes for local breeds. *Ex situ* conservation requires appropriate infrastructure and organization, technical capacity, legal arrangements and sustained funding (Hiemstra *et al.* 2005).

There is an urgent need to place due emphasis on conservation and sustainable use of AnGR. The major responsibility for conservation and sustainable use of AnGR lies at the national level (CBD, 1992 and 2002).

However, international commitment in terms of supporting national policies is also likely to be important (MoEF and Department of Animal Husbandry and Dairying). The international process covering potential AnGR policy and regulatory frameworks will not only raise awareness of global political and policy levels, but may also result in coordination and collaboration arrangements at regional and/or global levels.

xii. *Community species interaction*: Role of communities in biodiversity conservation in an ecosystem-level theory deals with species distribution, the role and function of key species and community role and interaction in different geographical regimes. Species functions and community level interaction play most important role in their conservation (Tisdell 2003, Erenstein *et al.* 2007, 2010).

Ecosystem diversity is the least-understood level of the 3 described here due to the complexity of the interactions. Trying to understand all the species in an ecosystem and how they affect each other and their surroundings while at the same time being affected themselves, is extremely complex.

This lack of sharp boundaries is known as “open communities” (as opposed to “closed communities,” which would have sudden transitions) and makes studying ecosystems difficult, since even defining and delimiting them can be problematic.

Characteristics of communities are unique and cannot be extrapolated from the species level only. Examples of these characteristics include the levels of the food chain and the species at each of those levels, guilds (species in a community that are functionally similar) and other interactions. These factors play major role in *in-situ* conservation strategy of biodiversity conservation.

4. Animal welfare addressing climate change

The most recent task of Animal Welfare Division is monitoring and development of mitigation strategy of Carbon Foot Print of animal based actions and systems. This includes Farm Animal Welfare (Terrestrial Codes), Wild Animal Welfare and Aquatic Animal Welfare Codes. More than 120 leading scientific and technological institutions in India continuously measure, monitor and evaluate the impacts of climate change on different sectors and in different regions of our country. In addition MoEF has proposed to esteem a nationwide climate observatory network to monitor the climate change and its impact.

Intensive crop production (often based on monocultures and high productivity) depends greatly on external inputs such as mineral fertilizers and pesticides. But organic sustainable agricultural practices reduce the reliance on external inputs by following technique of

- recycling wastes as nutrient source,
- using nitrogen-fixing plants,
- improving cropping systems and landscapes, and
- avoiding synthetic pesticides.

In order to avoid nutrient losses, especially since nutrients are limited in low-input systems, soils should be covered permanently by crops in an optimized sequence. As purchased organic fertilizers are expensive, organic farmers have not only environmental reasons to avoid losses, but also economic incentives (Erstein *et al.* 2007, 2010, Varma *et al.* 2007).

Watershed management technology of integrating crop, livestock, fodder, pasture, aquaculture, water management, processing, value addition and conservation on natural ecosystem is the science of farm animal welfare (Varma 2008, Varma 2010).

Methane myth: Methane accounts for about 14% of all greenhouse gas emissions. Two-thirds of the methane emissions stem from enteric fermentation and manure management and, as a consequence, are directly proportional to livestock numbers. The data available on methane emissions from livestock is limited and questionable which is based on theoretical assumptions. Some scientists infer that high-energy feedstuff to reduce methane emissions from ruminants but the ruminants’ unique ability to digest roughage

from pastures would then not be used. Furthermore, meat and milk would be produced with feed concentrates produced in remote arable lands, which make intensive use of mineral nitrogen (an important CO₂ emitter), and which use crops for feed rather than for food, with the attendant human nutrition implications.

Another positive difference between organic and conventional cattle husbandry is that organic breeders aim at longevity. The ratio between the unproductive phase of young cattle and the productive phase of dairy cows is favorable in organic systems because, calculated on the basis of the total lifespan of organic dairy cows, less methane is emitted. On the other hand, lower milk yields of organic cows caused by a higher proportion of roughage in the diet, might increase methane emissions per yield unit.

Storage and composting of manure and organic waste have been strongly improved on organic farms in recent years. Using the modern techniques, such as covering, processing compost and steering the compost process, prevents leaching and reduces N₂O emissions.

Composting manure may reduce CH₄ but enhance N₂O emission from heaps. Compost use can greatly enhance carbon sequestration in the soil compared to raw manure use. Finally, biogas production from liquid slurry makes use of the evolving CH₄ for energy and is applied by many sustainable farmers.

Global concerns and issues: Animal welfare achieved very high significance when it was included in green box of WTO agenda and in OIE global Conferences (2004 and 2008) as primary concern of animal production and health codes. The OIE in First Global Conference on Animal Welfare in February 2004 representing the 174 Member Countries, targeted livestock producers and actors in the meat sector, veterinary practitioners and international nongovernmental organizations (NGOs) to adopt animal welfare while addressing animal health and production technologies in their economic pursuit. It is now a subject of top most concern for cooperators, consumers, veterinarians, environmentalists and activists. Codex Alimentarius, OIE and WTO (Three Boxes), FAO (Biodiversity Conservation Guidelines), WHO (Food Safety Norms), World intellectual property rights, Food Standard Bill 2005, Codes of Fast Food Chains and Global Laws of Biodiversity Conservation are important areas of Animal Welfare Education. Animal Welfare economizes farm animal production, improves wild life conservation and pet animal behaviour and also aquaculture management and production.

National action plan on climate change

India has a detailed national action plan on climate change with eight focused national missions and twenty-four critical initiatives, e.g. solar energy mission and a domestic market-based mechanism for stimulating energy efficiency in industry; accelerating afforestation, for promoting sustainable

habitats, for expanding sustainable agriculture and for protecting the crucial Himalayan ecosystem. New GHG emission-reducing technologies in coal-based power generation are being deployed on a large-scale. Mandatory fuel efficiency standards in the transport sector will soon become a reality. Indian version of an IPCC was established, comprising more than 120 of our leading scientific and technological institutions to continuously measure, monitor and model the impacts of climate change on different sectors and in different regions of our country. In addition to establishing a nationwide climate observatory network, a satellite is to be launched in 2011 to monitor GHG and aerosol emissions globally. Over the last decade we have added over 3 million ha to our forest cover and today our forest cover is sequestering close to 10% of our annual greenhouse gas emissions. We will endeavour to maintain that level. India has been a major participant in the CDM. If all Indian projects are approved and implemented as scheduled by 2012, carbon credits amounting to a further 10% of our annual GHG emissions will be available to developed countries to enable them to meet their KP (Kyoto Protocol) commitments. India is convinced that a low-carbon strategy is an essential aspect of sustainable development. Deeply conscious of its international responsibilities as well, India has already declared that national per capita emissions will never exceed the per capita emissions of the developed countries. India has recently unveiled projected GHG emissions profiles till the year 2030. India is transforming its environmental governance systems. A judicial National Green Tribunal and an executive National Environmental Protection Agency is on the anvil. Just announced new generation of national ambient air quality standards are on par with the strictest in the world.

As a global goal, India subscribes to the view that the temperature increase ought not to exceed 2 degrees Celsius by 2050 from mid-19th century levels.

5. Livelihood and employment potential

The Welfare Science of Animal in future will play major role in conservation of genetic biodiversity, food safety, captive animal breeding, wildlife management, safety of coastal and island wild animal life, revival of endangered species of animals through animal welfare related behavioral and environmental enrichment. Recent teaching courses for Border Security Force and Indo-Tibetan Border Police focused mainly on disaster management (Varma 2010b). Equine and Dog Welfare, these courses were tailor-made suiting to the basic duties of these para military forces. In other words it was optimum Animal welfare strategy.

Areas of future employment

- i. Veterinary Science Graduates and, P Gs & Researchers engaged in farm animal welfare, wild life and zoo management, captive animal breeding and aquatic wild life management

- ii. Forestry and Wildlife graduates
- iii. Fishery and ocean Science graduates and PG
- iv. Food Science and Food Safety Management graduates and Animal Fast Food Chain managers
- v. Municipal managers in abattoirs
- vi. Officials in animal transport industry e.g road, rail, sea and air
- vii. Gaushala managers and NGO officials
- vii. Animal breeding Scientists and Geneticists
- ix. IPR and CBD officials
- x. Scientists in Zoonotic Disease Management, Vaccine Production & Pharmaceuticals
- xi. Animal Rescue Technicians in paramilitary organizations (BSF & ITBP) involved in Disaster management
- xii. Officials in Defence and paramilitary force engaged in management of animals used in policing work like dogs, equines and camels
- xiii. Livestock food trade, import, export and quarantine
- xiv. Legal experts in animal laws
- xv. Animal activists, PETA officials, CPSCEA and Animal Welfare Audit officials and others

ACNOWLEDGEMENT

The author has trained more than 75 batches of animal welfare trainees in National Institute of Animal Welfare, Animal Welfare Division, MoEF. I express my gratitude to Secretary & Joint Secretary MoEF and Director, Animal Welfare Division of MoEF. Author expresses gratitude to the Project Manager in EdCIL, (MoHRD) & Amity Institute of Training and Development (AITD), NOIDA.

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